AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

VIDEO, HIFI & COMPUTERS

OCTOBER, 1982 AUST $2.00 * NZ $2.50

Registered by Australia Post — publication No. NBP0240.

DIGITAL READOUT FOR SHORTWAVE RECEIVERS

- ADD SPEECH TO YOUR COMPUTER
- SHURE V-15 TYPE V REVIEWED

DICK SMITH "WIZZARD" VIDEO GAME REVIEW

Power you can taste.

Sony's new TA-AX5 amplifier with memory is a high fidelity feast.

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Sony's Audio Signal Processor means that every function is touch controlled. This knifes through the usual maze of audio circuitry for a streamlined design of the future. Pure and simple, it sounds delicious.

TA-AX5

The ideal companion for this tasty new amplifier is Sony's ST-JX4 synthesizer tuner. Why not make a reservation for two?

ST-JX4

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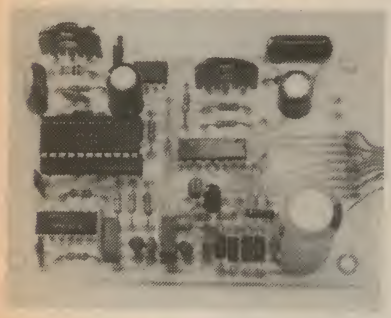
ELECTRONICS AUSTRALIA

Volume 44, No. 10
October, 1982

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

Computer speech synthesiser



Based on the Votrax SC-01 chip, this speech synthesiser can be used with any computer that has a Centronics printer interface. Details page 72.

Our Car Computer has a rival! It's called "Voyager", it comes fully assembled, and we tell you all about it on pages 26-28.

COMING NEXT MONTH! – Find out what's coming by turning to page 107.

On the cover

Want to add digital frequency readout to a shortwave receiver that uses an old-fashioned analog dial? This unit features a bright 4-digit LED display, 1kHz resolution, and a fast 0.2s update time. Construction starts on page 48.

FEATURES

HIFI, VIDEO AND REVIEWS

PROJECTS AND CIRCUITS

PERSONAL COMPUTERS

COLUMNS

DEPARTMENTS

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Editorial Viewpoint

The standards, they are a - falling . . .

Attention all you keen ABC-watchers out there! How many of you regard the ABC technical standards as being second-to-none in Australia? A large number of people do watch the ABC but many must be disappointed in the declining standard of presentation. This topic was prompted by a recent critical review of ABC news presentation in the "Sydney Morning Herald" (1st September). The article was entitled "And Jim Dibble reaches for the telephone, smiling bravely".

While one might discount the newspaper article because of connections between the SMH and the Seven network, the criticisms were only too true. Nowadays there are so many technical blunders on the ABC that they do not even bother to acknowledge or apologise for them. Recently, for example, the ABC were showing preview scenes for a coming series which were plagued with intermittent loss of picture and sound. This happened on several different occasions.

One sometimes gains the impression that no one at the station is actually monitoring the signal going to air. Or were the preview scenes factual and was the subsequent series intended to be shown with dropouts?

This evidence of declining standards is not a recent phenomenon. It's been going on for years. It is true that there have been some cutbacks in the ABC's budget but that is no excuse. And while some of the technical problems are due to lack of maintenance, others are presumably caused by a sheer lack of care.

I am certain that there are a great many people in the ABC who work diligently to produce a fine result. I am just as certain that there must be a fair proportion who could not care less. And this even becomes evident in the production of some ABC shows. Compare, for example, the indifferent presentation of the series "Towards 2000" with the thoughtful and informative presentation of "Countrywide" or the highly polished presentation of the "Saturday Show".

And while one may not like what is broadcast on the commercial networks there is no doubt that their technical standards are high and their presentation is really slick. Technical problems are rare, or at least, rarely seen.

While I prefer to watch the ABC, it is obvious that their technical performance is patchy. It should set and keep the highest standards. It is, after all, our national broadcasting network. We should be able to feel justly proud of it.

Leo Simpson

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7.5k
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Written by Pedr Davis

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VOTRAX TYPE 'N TALK

With this advanced speech synthesiser your computer can now talk to you simply and clearly with an unlimited vocabulary. By adding a truly flexible and easy to use speech facility to any computer, it opens up whole new fields of applications computers for the blind, language teaching, computer - aided teaching for small children and the illiterate. And of course Type 'N Talk is great fun for computer games. The Votrax is supplied with 240V power supply and user manual. You only supply a speaker and a cable to connect to your computer! Cat X-3290

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YES! IT ACTUALLY SAYS IT FOR YOU!

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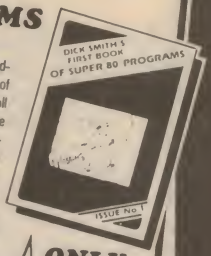

New from Dick Smith Electronics, this superb hand-book gives you a collection of handy Super 80 programs all written in BASIC. Most of the programs are for your amusement, but there are some business onentated programs which could apply in small busness situations. Learn more about the Super 80 and the actual programming of the computer. And look at the great price! Cat B-3606

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A true discriminator

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A great unit for beginners! Ideal to throw in the car when you go away for a weekend or on holiday. Provides endless hours of fun and the whole family can join in as well. Lightweight and very easy to use. Cat Y-1066.

$99 WAS $149

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MAKE A NOISE THIS XMAS . . . BUILD AN ELECTROCHUNE

ONLY $75.00

A mini synthesiser with a 23 note touch keyboard. It even has a built-in amplifier and speaker with seperate volume controls. Complete with plugpack and full instructions. Cat K-3506

HAVEN'T BUILT ONE? See Page 19. You could save a fortune!

DON'T FORGET — IT'S ONLY 11 WEEKS TILL CHRISTMAS!

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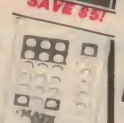
SAVE $5!



The exciting way to learn maths! Poses problems and maths games and incorporates an audio high score indicator. From Texas Instruments, it's just right for grades 1 to 6. Cat Y-1321.

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OVER 200,000 SOLD! ORIGINALLY SOLD FOR $250!!

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Convey your thoughts and words into another language. Great for travelling overseas, politicians, students etc. Cat Y-1340

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Fits on standard ⅜ base (Cat D-4056) 1.3m long — fibreglass construction. Cat D-4205

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Plugs directly into your 207 or 208. Operate hand held with a minimum of fuss — very small and light. Cat C-1111

and its only $32.50

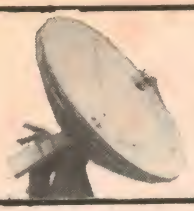
DICK SMITH WIZZARD

The ultimate TV game with a computer built in. See page 129 for details

DICK SMITH ELECTRONICS

See Page 98 for address details

DSE/A357/LM PAI



News Highlights

When it has to get there fast — send it by carrier pigeon

When it absolutely has to be delivered on time, Lockheed Corporation, one of the most advanced space and computer technology companies in the world, turns to — carrier pigeons.

"The first reaction to using pigeons was just what you would think – laughter," said research chemist Werner Deeg, who volunteered to train the birds. "They said, Lockheed with pigeons? You must be crazy. We have an image to protect."

But Lockheed Missile and Space Co, perhaps best known for "birds" such as the Trident nuclear missile, has found a use for carrier pigeons at the company's mountaintop research centre outside Santa Cruz, California.

The Felton test base uses pigeons to fly daily microfilmed prints of graphics design projects over the mountains separating them from Lockheed's Sunnyvale headquarters. The graphics design systems enable Felton's designers to draft directly onto a video screen, automatically storing the information in a computer at Sunnyvale.

Previously there was no fast, economical way for the Felton designers to retrieve daily work copies from the system. The company's mail carrier had to travel over 80km of twisting mountain roads, so delays of up to one day were common.

A computer specially acquired to transmit the needed designs from Sunnyvale to Felton is now only used as a back-up for the pigeons because, at $10 a print, it is too expensive to run.

SONY UNVEILS COMPACT DISC PLAYER

Sony unveiled the first production versions of its revolutionary compact audio disc player during mid-August. Then it cast a shadow over the unveiling by announcing that it is to delay the full launch of the system in Europe until next year.

Compact discs, jointly developed by Philips in the Netherlands and Sony in Japan, promise sound quality presently unobtainable with conventional hifi systems. Each disc, measuring only 12cm in diameter, can store an hour's programming on a single side, coded digitally in the form of microscopic pits.

These tiny pits — formed in a reflective metallic surface — are buried beneath a protective plastic layer and are read by a laser beam. Unlike conventional LPs, the discs do not deteriorate with repeated playings and are unaffected by surface scratches, dust or finger marks.

Sony attributes the delay to its inability to produce sufficient players to support an early launch.

Computer war danger — expert warns

Donn B. Parker, a world authority on computer security, has sketched a scenario for the computer wars of the future – which has nothing to do with Space Invaders.

Speaking at a recent computer security conference in Monaco, the US expert warned that the threat of nuclear war could soon be joined by the prospect of intentionally caused economic collapse brought on by manipulation of selected computers.

Parker predicted that wars fought by and against computers could involve alteration of global weather forecasts to manipulate commodities markets, secret alteration of computer files that control the distribution of energy within a country, or perhaps a shut-down of the Electronic Funds Transfer network, which already moves US$600 billion between international banks each day.

Many of the computer systems used by governments and businesses are inadequately protected, Parker argues. Increasing centralisation and sheer volume of information handled by computers and the growing use of international data links pose problems which have yet to be looked at, he claims.

Satellite terminal for British Army

The British Army is currently testing a compact terminal for spoken and telegraphic communication by satellite. Known as "MANSAT", the unit can be transported and operated by one person.

Speech and 50-baud telegraph facilities are provided by the terminal, operating in the 7-8GHz band. The operator can wear a headset with built-in microphone or connect a small telegraphic data terminal with keyboard and printer to the backpack.

Under field conditions the equipment can be set up and contact established with a base station, via satellite, in under two minutes.

Amateur Dx-pedition

An international expedition of radio amateurs proposes to visit Heard Island (75°E, 53°S) during the first three months of 1983. Aims of the "DX-pedition" are to make at least 50,000 world-wide radio contacts during the four week stay, to circumnavigate the island, scale the 2745m mountain "Big Ben", and make a film of the journey.

A number of Australian and international DX organisations are sponsoring the expedition, and the Wireless Institute of Australia has agreed to act as trustee for donations. Call sign for the expedition will be VK0HI.

More donations are needed to meet the costs of the DX-pedition. Contact the WIA, Box 10, West Perth, WA, 6005.

Moree earth station upgraded for Intelsat V

The Overseas Telecommunications Commission's satellite earth station, Moree 1, is being extensively upgraded to allow its use with Intelsat V, the newest generation of communications satellites

Scientists from the CSIRO Division of Radiophysics are collaborating with OTC engineers. Based on extensive work on radio telescopes, the CSIRO scientists have designed a new feed horn for the 27.5m diameter parabolic dish antenna. The redesigned feed horn directs microwave transmissions to the antenna sub-reflector (in the centre of the dish) with high precision and efficiency.

Manufacture of the new feed horn and sub-reflector was a co-operative effort between private industry, the Radiophysics Division's own laboratories and Government owned workshops.

The Intelsat V satellites now coming into operation have twice the channel capacity of the Mark IV series they replace, allowing the equivalent of two television channels and 12,000 two-way telephone circuits within each satellite's bandwidth.

View at right shows the Moree 1 Earth Station antenna prior to upgrading with the new feed horn.

A tribute to Doug Ferguson

Many people in the Australian electronics industry were saddened, recently, to learn of the death of Doug Ferguson, founder and Managing Director of Ferguson Transformers Pty Ltd, Chatswood, NSW. He will be remembered by associates and employees alike as a friendly, unassuming man who said what he meant and meant what he said.

I recall a particular day in 1945, when Doug called into our office in Elizabeth Street, Sydney – a young fellow of about my own age, keen to plan for the future. After the usual courtesies, he said:

"I'm thinking of getting into transformer manufacture for the kit market. What do you think?"

I had met Doug, some years earlier, when I was with Amalgamated Wireless Valve Company, and Doug was running a small radio service business which later blossomed into small-scale receiver manufacture. He was a good customer for Radiotron valves.

In answer to his question, I told him that the ordinary power transformer market was well served but that a unique opportunity was opening up to design and market vibrator type transformers for car radios and other battery powered receivers and amplifiers.

Doug took up the suggestion and, shortly afterwards, the first of many projects using a Ferguson transformer appeared in "Radio & Hobbies", as our magazine was then called. The association has continued right up to the present day, although Ferguson transformers had their most obvious presence in the valve-type stereo Playmasters of the '60s.

Doug is no longer with us but the company he founded and the name which he left behind will continue to be known and respected in the Australian electronics industry.

Neville Williams

CSIRO tracks volcanic ash cloud

Australian scientists have developed a method of tracking the clouds of ash released by volcanic eruptions. The clouds pose a severe threat to aircraft and have several times fouled jet engines.

A team from the CSIRO and the Western Australian Institute of Technology in Perth has developed a method which allows the clouds to be tracked as they disperse and rise into the altitudes used by large passenger jets.

The basis of the method is interpretation of pictures received from weather satellites. Unfortunately, as the clouds disperse at the heights where they are dangerous, they become very difficult to detect. In fact, the only satellite which is able to provide enough data is the United States NOAA 7. This is able to record both visible light and heat from the atmosphere, and land or water surfaces.

The key to distinguishing the volcanic ash clouds was the realisation that they had a high mineral content which gave them a characteristic thermal emission pattern. The difference is slight, however, and a two-day programming effort was required to show up the difference on a computer display.

The team capped a week of discovery on Thursday, July 22, by tracking, at the request of the Department of Aviation, a cloud of ash released by an eruption in Bali. The cloud was detected 1200km north-west of North West Cape and about 500km south of Java.

News from the video disc front

In Britain there has been a slow build-up of interest in the Laserversion disc player. Standard systems are selling for £450, with deluxe remote control models at around £500. Discs are selling at around £15-16.

A new video disc production process has been introduced at Philips Blackburn, England, plant. Instead of stamping out the discs a liquid organic lacquer is poured into a master mould. The lacquer hardens when it is exposed to light, transferring the master information to the lacquer layer.

In the United States, RCA has introduced a new range of Selectavision video disc players, including a low-cost model and two versions with stereo sound. The cheapest machines are now selling at around US$300. Some reports suggest that this price cutting has been a contributing factor in the decision to postpone the worldwide launch of the VHD disc system.

NEWS HIGHLIGHTS

25th Jamboree on the Air

Thousands of scouts and guides throughout the world will participate in the 25th Jamboree on the Air during the weekend of 16th-17th October.

The annual Jamboree on the Air is a joint effort, worldwide, by Scouting groups and radio amateurs, the latter making their communication skills and equipment available to allow Scouts to talk to fellow Scouts in other towns, states, and countries.

The 25th Jamboree on the Air will commence in Australia at 0001 hours local time Saturday, 16th October, 1982, and terminate at midnight Sunday, 17th October, 1982. As in past years the official opening will be an address by the Chief Scout and Governor General of Australia over the national headquarters official scout amateur radio station VK1BP in the grounds of Government House, Canberra, at 1400 hours (2pm) Saturday.

Amateurs willing to assist can obtain full details from their local Scout or Guide headquarters.

New standards on motor vehicle EMI

New standards published recently by the Standards Association of Australia include AS 2557, dealing with electromagnetic interference limits for motor vehicle ignition systems. The standard was requested by the Department of Communications, supported by Telecom and road transport authorities. It covers only spark type ignition and not other sources of interference.

The standard is intended to limit interference from motor vehicles to mobile communications systems and traffic control equipment and to permit the detection of offending vehicles.

According to John Dixon of the Department of Communications and chairman of the SAA committee which produced the standard, present legislation does not require compliance with interference standards but legislative changes to the regulations are under consideration.

Benefits of the standard include less interference to communications such as mobile radio and public mobile telephone services and possibly less interference to broadcast reception in houses and shops adjacent to heavy traffic.

Copies of the standard can be purchased from offices of the Standards Association of Australia at a cost of $5.80 plus $1.25 postage and handling.

New speech synthesiser uses less memory

National Semiconductor Corporation has anounced a new speech synthesiser chip which is said to use 50% less memory and provide higher quality speech than its predecessor, National's Digitalker 1.

Other features of the new device include a wider power supply range, and pitch and inflection controls. Words stored in read only memories can thus be put together with external control of pitch and inflection, allowing smooth, natural speech cadences.

The new DT3101TD synthesiser chip provides natural sounding speech at data rates as low as 800 bits a second. Previous speech synthesiser circuits often require data rates at four times this speed.

Vacation camp has electronic projects

Each Christmas, a vacation camp for school students interested in electronics and/or photography is held at Mt Victoria, NSW. Known as CAMTEC, the camp is run by the Scripture Union, an interdenominational Christian organisation.

At CAMTEC, campers can construct electronic projects, study microcomputer programming, operate amateur radio station VK2BCT, and take, develop and print black and white photographs.

The camp is for boys in high school years 7 to 9 and will run from the 14th to 21st of January, 1983. Cost will be approximately $70.

For further information contact the Scripture Union, 1298 York St, Sydney 2000, phone (02) 290 1944.

Omega station now operational

The Australian Omega navigational station is now on the air and fully operational. It commenced operation officially at 10am on August 16th.

The Australian facility is the last link in a worldwide network of eight Omega stations. The others are in Norway, Liberia, North Dakota, Hawaii, La Reunion (a French island in the Indian Ocean), Japan and Argentina.

The Omega station, at Darriman in Victoria, was designed by officers of the Department of Aviation and the Department of Transport and Construction. It took three and a half years to build and includes a 427 metre high tower, the tallest structure in Australia.

The change to excellence in sound...

needn't cost you a fortune.

Denon, the name associated worldwide with professional audio equipment has available in Australia their range of superb quality turntables. A speed control system, with magnetic detection of impulses recorded on the inner rim of the turntable platter, coupled with a highly responsive A.C. servo motor maintains smooth and constant rotation.

Denon turntables are the result of 30 years of research and technology, giving you the ultimate combination of performance, reliability and cosmetic styling.

See the range of turntables at your Denon dealer now, you'll find their prices rather exciting as well. *optional tone arm and cartridge

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NEW STORE opening October in Carlingford

AT "NEVILLE'S CORNER" CNR CARLINGFORD & PENNANT HILLS ROAD, NEXT TO KENTUCKY FRIED CHICKEN

MR HOWARD—

* * * * *

DESPITE TWO SAVAGE INCREASES IN SALES TAX AND HEAVY DEVALUATION OF THE AUSSIE DOLLAR, WE ARE STILL PASSING ON GREAT SAVINGS! OUR GREAT PRICES CAN'T LAST FOREVER SO ACT NOW! (BEFORE MR. HOWARD DOES — AGAIN!)

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A bulk buy of these has enabled us to pass on great savings!!
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— 10 million operations
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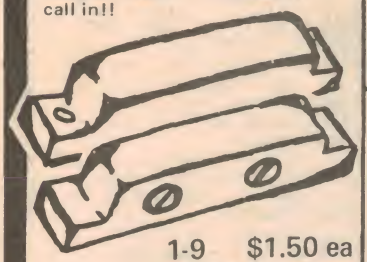
— Screw mount as well!
Staggering value.
Jaycar has a complete range of Burglar alarm components — call in!!

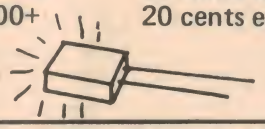


1-9 $1.50 ea
10-99 $1.40 ea
100+ $1.25 ea

Rectangular LEDs * * *

These are quality 2mm thick polished LEDs (similar to Siemens) — not the cheaper 3mm thick unpolished LEDs. Colours available: Red, Yellow Green. Normally $0.60 for this quality
BUT NO!!
Not $0.40 not $0.30 but as low as $0.20 each!

1-9 25 cents ea
10-99 22 cents ea
100+ 20 cents ea



Zener Diodes

Improve your Dowry with these! The following values only (5% 1 watt).
9V1, 10V, 13V, 16V, 20V, 22V 24V, 30V, 39V & 56V.

15¢ each
$1 for 10!

DPDT * * Footswitches

Double-Pole Double Throw Footswitches.
We had to import these ourselves to get the quality at a reasonable price.
Heavy duty. Ideal for any musical effects-pedal application.

$6.95

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Ample stocks of these boards plus the range has been extended.

WBDN	100 holes $2.50
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Weller SPARES

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SW-60D	Switch assembly	$29.50
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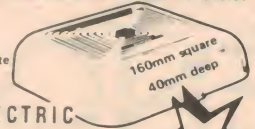
TRUELY GREAT BARGAINS — * * * *

FROM GENERAL ELECTRIC

Smoke Detector *

CONSUMER FLOP — CONSUMER FLOP
CLUB, HOTEL, HOSTEL & MOTEL MANAGERS
PLEASE NOTE
One of the greatest consumer flops of the last decade was the Ionization Chamber Smoke Detector. Even though it is a brilliant product (reliable compact, easy installation, fail-safe etc) it just did not sell. Human nature being what it is finds safety oriented products just not worth the investment. We all know that accidents and fires never happen to US!!
As smoke is the greatest killer in a fire, the market research gurus thought that such a product would have wide appeal.
When they were $49.50 no-one wanted them. The price fell to a very reasonable $29.50 and still they stayed on the suppliers shelves.
We have now been in instructed to clear them for less than ½ of $29.50

- Contains Americium 241 Ionization Chamber
- 9V Mallory Duracell included
- Contains very loud solid state buzzer
- 12 month factory warranty



GENERAL ELECTRIC

Grab One NOW $14.50

* FAMOUS * GENERAL ELECTRIC
BURGLAR ALARM SLASHED!!!
HUGE SCOOP PURCHASE — ONCE SOLD FOR OVER $100

* *Slashed to* $29.50 *

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SAVE A FORTUNE — COMPARES WITH UNITS OVER $100
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car DC-DC inverter

Very low cost 12V DC/DC Inverter. Plugs into car cigarette lighter and powers 6V, 7½ and 9V equipment @ 800mA.

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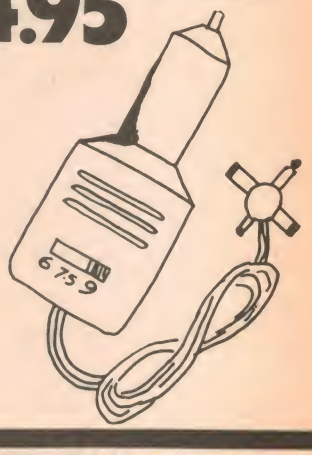

MUFFS SCARCE — GRAB NOW!!

ONLY $5.95 for a set of two
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Spruce up your Headphones with these bright Blue earmuffs.

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JAYCAR VALU-PACKS. QUESTIONS RAISED IN PARLIAMENT

In the last few months Jaycar's valu-packs have become legendary. Trimpot packs sold out in days. Photocells – well we THOUGHT we had a lot! We kept the pot packs going for about 6 weeks but the staff threatened to go on strike! (We ran out anyway).

Now we have more!!

The Treasury are wondering how we can do it! Could we be getting them from the bottom of the harbour? Are we applying the right sales tax? The Opposition is demanding a Royal Commission but we think the Government will tough it out. Subscribe to Hansard for further news!

Lamp Bezel Pack

– IT HAD TO HAPPEN

Only Jaycar would have the audacity to offer a Lamp Bezel Pack!!
This fantastic pack contains an assortment of incandescent bezels (MES and Lilliput) neon bezels and LED bezels. Over 20 in all!! The average price of each bezel is $1.50 So you will gasp when we tell you the price –

$7.95

Alligator Clip Pack

HEATH ROBINSON EZ HOOKS

These are'nt on the protected list! A bulging bag of gorgeous grippers. From gnat-like nippers to finger chompers. Grab a bag now before they grab you!
Over 25 clips in each bag.
VALUE AT $7.95
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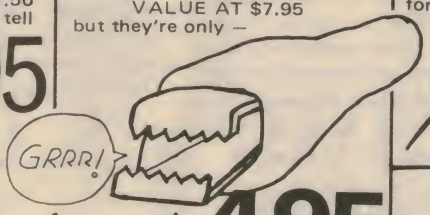


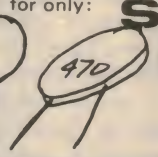
$4.95

Great for battery chargers, paper clips and 000's other uses!

Silver Mica Pack

SUPERB VALUE

Probably the most stable capacitors of the lot. Pack of 100 SM's in values ranging from 33pF to 1000pF @ 100V.
Silvered Micas are hard to get now and are normally VERY expensive.
Worth well over $40 but yours for only:



$8.95

Thermistor Pack

NEW LOW PRICE

470 ohms @ 25 degrees C NTC THERMISTORS – were $0.20 each (which was cheap) now:

$1 for 10

NIXIES * *

If you are over 30 you will know what these are. To the uninitiated they are basically a Valve version of a 7 segment LED display!
In the 60's they were the ONLY type of electronic display around Grab one for your kids. Great curiosity value.

ONLY $1.00 each

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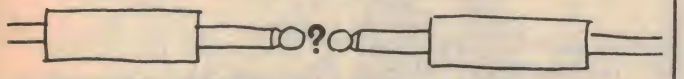
We have double female. We also have the opposite! And some weird combinations in between. Each adaptor is solid metal and high quality and we can't see the reason why some were over made and we're sick of looking at 'em.
You get 12 in a bag and if you only use ONE once they will owe you nothing. Once sold for $3 each, but we won't insult you by claiming $36.00 'value'. A bag will cost you $3.95.
MR HOWARD – EAT YOUR HEART OUT!



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Spruce up those hard working TO-3's with our upgrade pack. Each pack consists of the following:
– 6 quality McMurdo TO-3 Covers
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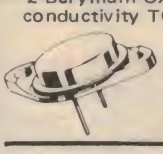
– 2 Beryllium Oxide high conductivity TO-3 washers



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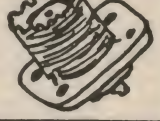

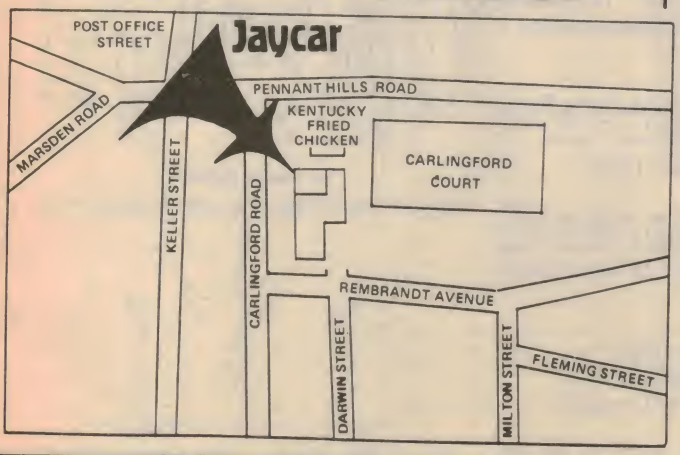

Factory Seconds YOU come FIRST

We have secured a smallish quantity of 5 pin DIN to 4 RCA audio leads that are on the wrong side of the Q.C. inspection. Shame though. Because the DIN plug is ALL METAL and GOLD plated. So are the RCA plugs. Problem is that the gold plating is bubbling on the gold DIN plug. (As far as we can see the 4 gold RCA's are PERFECT.)
An ordinary NICKEL PLATED lead set like this costs around $4.75. The gold versions normally are around $9.95. You can have one of these for $3.95 and that's better than Nickel any day! Worth it for the 4 x RCA's alone!

$3.95

RCA PIN PLUG×4

MINIMUM MAIL ORDER VALUE $5.00

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NEW SHOP HOURS
Mon-Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Amplitude the basic

So you think you know all about radio? Many people take the terms AM and FM for granted, without really knowing what they mean. In the first of two articles the author explains the basics of the Amplitude Modulation method of radio transmission.

by ELMO V. JANSZ, VK7CJ

Radio stations broadcasting to the public do not operate in the audio frequency range. The audio frequencies, the range of human hearing, lie in the range 20Hz to 20kHz, although this varies with the individual.

Audio frequency information is used at the receiving end so we may ask "Why don't we transmit in the range 20Hz to 20kHz?"

There are a number of reasons: If all the broadcasting stations in a given locality transmitted simultaneously at audio frequencies, the airways would be blanketed by freqencies within the range 20Hz to 20kHz, and they would interfere with each other's transmission.

Also, from the basics of antenna design, the optimum size of an antenna is one-half or one-quarter of a wavelength. Calculating the value of a half wavelength at audio frequency gives 7,500,000 metres at 20Hz and 7,500 metres at 20kHz. These figures are obviously physically impractical.

How is the problem overcome? The answer lies in imposing the audio frequency information to be transmitted on to a higher frequency signal called a "carrier". When this compound signal is received the two signals are separated in the receiver and the original audio information is recovered. Each station broadcasts using a different carrier frequency, so we can select the transmission of interest and eliminate all others by means of tuned circuits in the receiver.

The process of imposing audio frequency information on another signal of much higher frequency is called "modulation". The compound waveform, after the modulation process has taken place, is called the "modulated signal". There are, very broadly, two basic types of modulation – Amplitude Modulation (AM) and Frequency Modulation (FM). In this article we shall have a closer look at amplitude modulation.

In amplitude modulation the amplitude of the carrier is varied in accordance with the amplitude of the audio signal. Fig. 1 shows the three waveforms involved. Fig. 1a shows the audio information or modulating signal, Fig. 1b shows the carrier waveform and Fig. 1c illustrates the modulated carrier waveform.

For those who are mathematically inclined the unmodulated carrier can be expressed by an equation of the form:

$$y = B \sin 2\pi f_c t$$

where f_c is the frequency of the carrier in Hz. Similarly, the modulating signal can be represented by:

$$y = A \sin 2\pi f_m t$$

where f_m is the frequency of the modulating signal in Hz.

Modulation index

An important term, which is used in dealing with amplitude modulated signals is the Modulation Index which is defined as follows:

$$m = \frac{\text{Peak value of Modulating Signal}}{\text{Peak value of Carrier Signal}}$$

in this case m = A/B (See Fig.1).

Again, using a little more mathematics, the composite modulated wave form can be represented by an equation of the form:

$$v = V_C \sin 2\pi f_c t + \tfrac{1}{2} mV_C \cos 2\pi (f_c - f_m) - \tfrac{1}{2} MV_C \cos 2\pi (f_c + f_m)$$

where V_C is the peak value of the unmodulated carrier, represented so far by B. V_C is the accepted jargon in communications.

Frequency spectrum

Let us now look at this equation more closely and try to interpret its various components in more down to earth physical terms. The modulated wave form is seen to have three frequency components; f_C, $(f_C - f_m)$ and $(f_C + f_m)$. If this modulated wave form is examined on a spectrum analyser – an instrument used to analyse the various frequency components present in a compound wave form, a frequency versus voltage spectrum as shown in Fig. 2 will result.

The frequency $(f_C + f_m)$ is called the

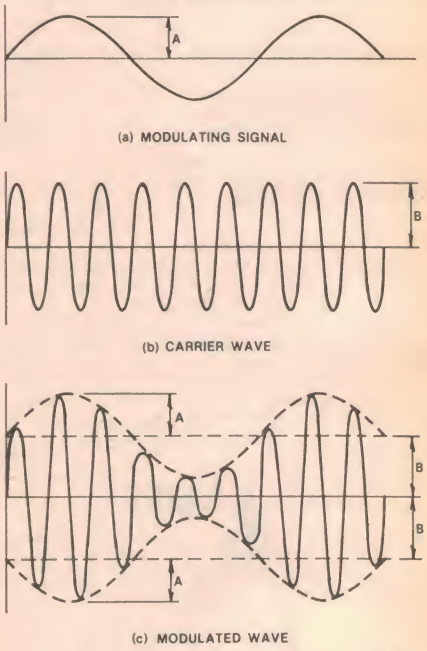


Fig. 1: illustrating the principles of AM.

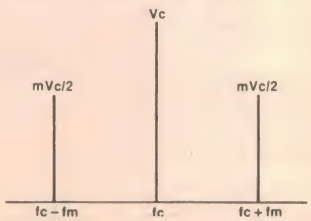


Fig. 2: frequency spectrum of an AM waveform.

modulation: concepts

upper side band, while the frequency ($f_C - f_m$) is called the lower side band. These are the frequency components that are used in single side band transmissions. The amplitudes of the side bands are each equal to $\frac{1}{2}mV_C$. Observe that this quantity depends on the modulating factor m.

Power content

The total power content of the amplitude modulated signal can be represented by an expression as follows:

$Pt = \frac{1}{4} m^2Pc + \frac{1}{4} m^2Pc + Pc$ Watts

where

Pt = Total Power

Pc = Carrier Power

m = Modulation Factor

Each of the terms $\frac{1}{4} m^2Pc$ represents the power of each side band. The above expression is normally simplified into the form:

$Pt = Pc (1 + \frac{1}{2}m^2)$ Watts.

This is a very useful expression in communications work, for it gives the total power of a modulated signal in terms of the carrier power Pc and modulation factor m.

We'll work through a little problem to illustrate the above ideas. We are given the carrier power as being equal to 60 watts and the modulation factor is 100%. We wish to find the total power of the modulated signal and the power in each side band.

We use $Pt = Pc (1 + \frac{1}{2}m^2)$

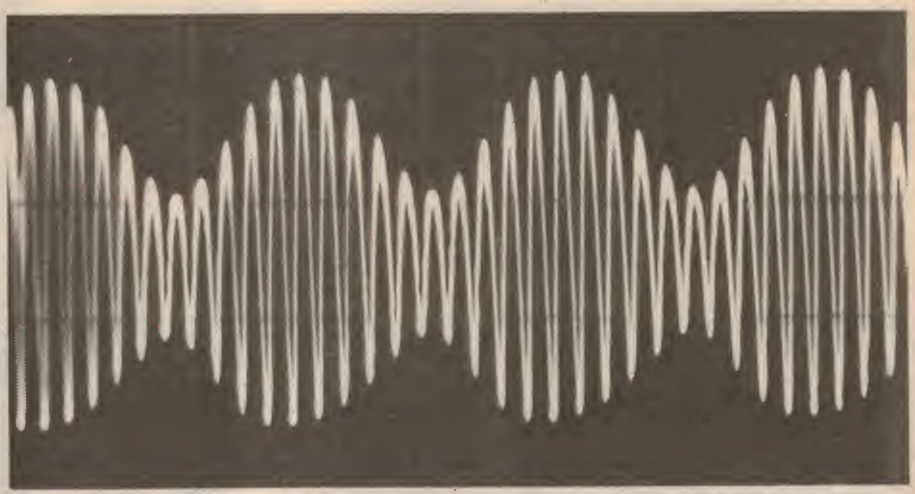
Pc = 60W, m = 100%

Therefore $Pt = 60 (1 + \frac{1}{2})$

m = 100% is m = 1.

Hence Pt = 90 Watts.

We know that the power in the upper and lower side bands are equal – each being equal to $\frac{1}{4}m^2Pc$. In this case, power in LSB = power in USB = $\frac{1}{4} \times 60 \times 1 = 15$ watts.



Taken from the screen of an oscilloscope, this photograph shows a modulated carrier waveform. Compare this picture with Fig 1 (c).

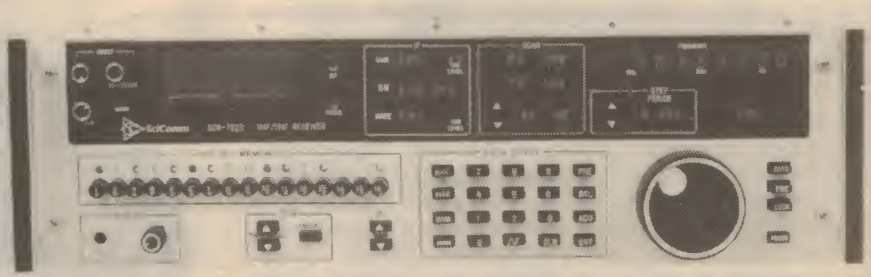
Conclusions

The above figures bear out some startling facts. Two-thirds of the total power is in the carrier, while only one-third of the total power is contained within the side bands. Such a system is not very efficient.

The significance of the presence of the sidebands is that each transmitting station occupies a band of frequencies rather than a single frequency, and the receiver must be capable of passing this band of frequencies for accurate signal reproduction. Actually, only one of the two sidebands, together with the carrier, is sufficient for accurate reception, allowing a saving in spectrum space. Single-sideband (ssb) transmissions are widely used in point-to-point communications.

Other methods have been developed to make better use of the available power. Some of these are Double Side Band Limited Carrier, Single Side Band Suppressed Carrier, etc.

Amplitude modulated broadcasts are susceptible to interference, or noise, because of the modulation method used. This is one of the reasons for the popularity of frequency modulation (FM), which we will be looking at in the second article.



Illustrating the modern trend in communications receivers, this VHF-UHF unit distributed by Vicom International provides program scanning and monitoring functions over a range of 20-1200MHz. It uses a microprocessor to control search and memory functions.

Floppy disk drives add versatility

Floppy disk systems are not cheap, but the advantages they offer frequently make them worth their cost. This article provides a handy guide to the various configurations.

by SCOTT PARKER

THE MORE YOU USE YOUR COMPUTER, THE MORE YOU learn about it. You will soon want to put the computer to practical use. Unfortunately, complicated tasks require a sizeable amount of computer memory and you will soon need more memory than is available with your computer's internal RAM. Also, you will want a fast method for saving and loading your computer programs. You can enter programs using the computer's keyboard, but for long and complicated programs this method is tedious and time-consuming.

The solution to those problems is to add a mass-storage device to your computer. A mass-storage device, such as a floppy-disk system or an audio cassette recorder, will increase your computer's memory capacity. In addition, a mass-storage device provides a non-volatile method of storing programs and data.

Chief among the advantages of a floppy-disk system over cassette tapes are higher speed and faster access time. Yes, a cassette recorder is cheap, fairly reliable, and easily adaptable to a personal computer. But it is slow, with a typical data-transfer rate between 30 to 150 characters-per-second (CPS). This means it may take as long as five minutes to load 10K of RAM. A floppy disk is faster and has other distinct advantages.

Access is faster since the read/write head in a floppy-disk system can reach a desired block of information without the need to pass through preceding data; that is termed random-access. On the other hand, data stored on a cassette tape is recorded serially, so all data preceding a desired block of information must first pass by the read/write head.

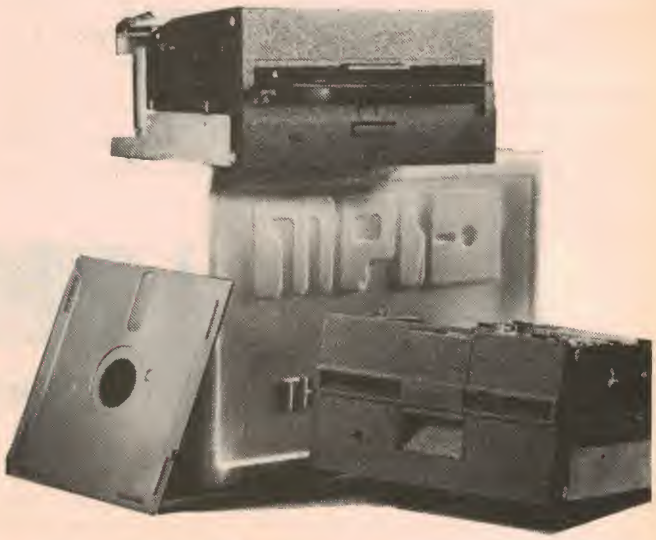
Let's illustrate what long access times can mean. A typical audio cassette used for small personal computers operates at a speed of 1.875 inches-per-second, and a 60-minute or 500-foot tape can store 500K bytes. To read one side of a cassette would take 30 minutes. Suppose you were to enter a list of names and addresses into your computer and then store it on cassette tape. If you then wanted to retrieve a particular name and address that was in the middle of the list, it would take 15 minutes to locate the address. A floppy-disk system with its random-access capability would retrieve that particular address in less than one second.

Once the particular block of information was located, the cassette recorder would transfer the data to the computer at a much slower rate than a floppy-disk system would. Stating it another way, a cassette system may have a data-transfer rate of 500 bits-per-second, compared to 15,600 bits-per-second for a 5¼-inch floppy disk, and 31,000 bits-per-second for an 8-inch floppy disk. (Eight bits are required for each character transferred. Also, bits-per-second is commonly referred to as baud rate.) In addition, most cassette recorders require manual operation, whereas a disk drive runs automatically after the disk is inserted.

Each 8-inch floppy disk can store up to 500K bytes (single-sided, double-density) or one megabyte (double-sided, double-density) of data. The smaller 5¼-inch diskette can store about 180K bytes (single-sided, double-density) or 360K bytes (double-sided, double density).

What is a floppy disk?

The flexible or floppy disk was introduced in the late 1960s by IBM to replace keypunch cards. It is soft and easily bent:



These large capacity MPI 5¼-inch drives feature high speed access. (Photo courtesy of Daneva Australia Pty Ltd.)

hence the name "floppy disk". The disk is currently available in two sizes, 8-inch (203mm) and 5¼-inch (135mm). The smaller 5¼-inch floppy disk is commonly referred to as a minifloppy diskette. The size is a measure of the sides of a non-removable square cardboard jacket that houses and protects the .003-inch thick, flexible Mylar disk. The disk is coated on both sides with a layer of magnetic oxides and revolves inside the protective jacket. The 8-inch disk rotates at 360rpm while the minifloppy runs at the slightly slower speed of 300rpm.

During reading or recording, a read/write head makes light contact with the disk surface. When data is not being written to or read from the disk, the read/write head is lifted from the disk surface to reduce wear.

As shown in Fig. 1, the jacket does not totally cover the Mylar disk. There is a slot to allow the read/write head to contact the oxide, a centre hole to permit the drive-motor spindle to rotate the disk; an index hole to provide specific timing information, and a notch (optional on the 8-inch disk, always present on the 5¼-inch disk) for "write-protection" to avoid accidental erasure of data recorded on the disk.

The "write-protect" notch is similar to the plastic tab on cassette tapes; when the tab is snapped off, the tape cannot be re-recorded. On a 5¼-inch floppy disk, the "write-protect" notch is covered to write-protect the disk and thus prevent wiping out programs and data stored on it. The procedure is reversed with the 8-inch disk. If the optional write-protect notch is present, it is covered to write-enable the disk.

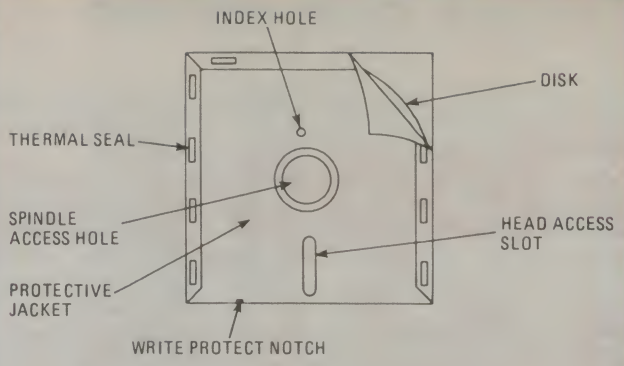


Fig. 1: A minifloppy diskette. On 203mm (8-inch) disks, the write protect notch is optional.

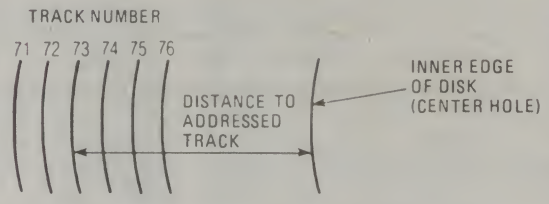


Fig. 2: The disk surface is divided into a series of concentric tracks to allow faster data access.

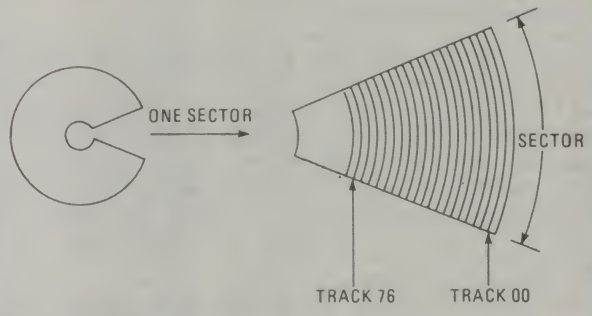


Fig 3: Each track is divided into sectors for more efficient storage of data.

Tracks and sectors

In some ways a floppy disk is similar to a phonograph record. A record stores music within grooves on a plastic surface; a floppy disk stores data as a sequence of magnetic pulses on a smooth magnetic surface. To read, or sense, the music on a phonograph record, a needle rides in the spiral groove and its mechanical vibrations are converted into electrical signals. In a disk system, there are no grooves; instead there are invisible tracks along which magnetic pulses are recorded. To read that data, a magnetically-sensitive read/write head is placed over the track while the disk is rotated. When data is to be stored on a floppy disk, the read/write head either changes the magnetic state of the oxide area it is contacting or else makes no changes; that produces the equivalent of a logic "1" or "0".

Continuing the analogy to a phonograph record, music is recorded in one continuous groove or track on the record surface, starting from the outermost edge of the record to the centre hole. That arrangement is fine, since the music will be played from start to finish – generally without the need for interruption. In a floppy-disk system, a great deal of data will be stored and fast access to any particular section of the data is essential. Now think how difficult it would be to locate a particular passage exactly on a phonograph record. It's not easy, but fortunately it's not often necessary.

To allow more rapid access of data on a floppy disk, a series of concentric tracks is arranged, with each track located at a specific distance from the centre (or the edge) of the disk, as shown in Fig. 2. Now each track can be identified easily or addressed by its specific location. Although there is a standard number of tracks (77) in the IBM 8-inch disk format, some manufacturers use different numbers of tracks. Some floppy disks are single-sided, with data stored on one side of the disk, while others are available with tracks and data stored both sides (double-sided floppies).

Although it is easier to locate a specific section of data using concentric tracks instead of a single continuous track, let's consider some of the drawbacks. If an 8-inch disk is divided into 77 tracks and various blocks of data (files) are assigned to individual tracks, there may be some degree of inefficiency. It is possible that one file may contain a relatively small amount of data; thus the track assigned to this file would barely be used. Another file may be much larger and use almost an entire track. A third file may require a bit more than one track and thus be assigned two entire tracks, again with little data on the second track.

To improve efficiency, tracks are divided into sectors, as shown in Fig. 3. Now data can be placed, and located quickly, by assigning a specific track and sector as its address. In the IBM format, for example, each 8-inch disk is divided into 77 tracks with 26 sectors per track for a total of 2002 sectors. Each sector holds 128 bytes or 1024 bits of information. Thus, a short file might fill a dozen sectors while a larger file could use an entire track of 26 sectors.

To locate the sectors on the surface of the floppy disk, either soft-sectoring or hard-sectoring is used. A soft-sectored disk has a single index hole; sector locations are identified by information recorded on the disk. That information must be stored within the sector and thus reduces the disk's actual storage capacity. A hard-sectored disk (Fig. 4) uses a number of punched holes to act as index markers; this scheme is about 25% more efficient in data storage. Hard-sectored disks contain 10 to 16 holes (32 holes in the case of some 8-inch disks) in addition to the index hole that is centred between two of the sec-

Floppy disk drives

tor holes. Circuits in the disk controller sense the shorter spacing between the index hole and the holes on either side of it and thus the system is aware of the starting point.

Still another analogy to the phonograph record: Just as an audiophile builds up a distinctive collection of choice records lovingly, so too can a computer buff collect pre-programmed disks that he has written and perfected. Disks, just like records, can be exchanged to permit other users to borrow special programs without the need to develop them. However, to exchange software via floppy disks, the formats of the disks must be compatible. In other words, you can not purchase software recorded on a 5¼-inch hard-sectored disk and enter it into your computer if your floppy-disk system requires soft-sectored disks.

One final analogy. Audiophiles take precautions when they handle their prized records; they hold the records by the edges to prevent fingerprints, dirt, or body oils from penetrating the record grooves and thus mar the fidelity of the sound. Floppy disks are considerably more vulnerable to careless handling; a dust particle or a strand of human hair deposited on the surface of a floppy disk could damage a number of sectors or impair good contact between the read/write head and the oxide coating. For that reason, users are advised to store the disk in its original envelope after use.

Floppy-disk formats

To promote the exchange of software among users, the computer industry has adopted the IBM 3470 format as a standard. Unfortunately, that standard can only be applied to 8-inch disks. If you are contemplating the purchase of a floppy-disk system, you should be aware that there is no industry-standard format for 5¼-inch disks. Also, if you are contemplating the purchase of an 8-inch disk system, you should make sure that the system is compatible with the IBM 3470 format.

The IBM 3470 format is shown in Fig. 5. The disk is divided into 77 tracks or concentric circles, with the count (00) starting at the outer edge; the innermost track is No. 76. Each track is subdivided into 26 sectors. Thus, there are 2002 sectors on a standard single-density 8-inch disk. The sectors are identified by soft-sectoring. Each sector is further subdivided into four sections: one to identify the sector and track number, one to accommodate 128 bytes (or 1024 bits) of data, and two gaps to separate the ID and data sections. The ID and data sections are further broken down so that in addition to containing the ID and data information, they contain pulses that are used to synchronise the controller circuitry to allow for variations in the rotational speed of the floppy disk. The ID and data sections also contain error-checking bits so that the controller circuitry can recognise an error when it occurs.

When a blank floppy disk is first purchased, its surface is non-magnetised and thus it must first be formatted to organise tracks and sectors. The microcomputer performs this function upon command, using the pulse representing the index hole as the reference point. After the disk has been formatted, it is ready to have information written on it or read from it. An unformatted 8-inch disk has a capacity of 400K bytes while its IBM 3470 formatted version can accommodate 256K bytes.

As previously stated, there is no standard format for the 5¼-inch minifloppy diskettes. The number of tracks and sectors can and does vary. For example, 5¼-inch diskettes for the Apple II computer were originally formatted with 35 tracks, each subdivided into 13 sectors with 256 bytes-per-sector. Later, that format was modified to 35 tracks with 16 sectors-per-track, resulting in a net increase of 24K of storage capacity. Diskettes for the Heath H89 computer are formatted with 40 tracks and 10 sectors-per-track.

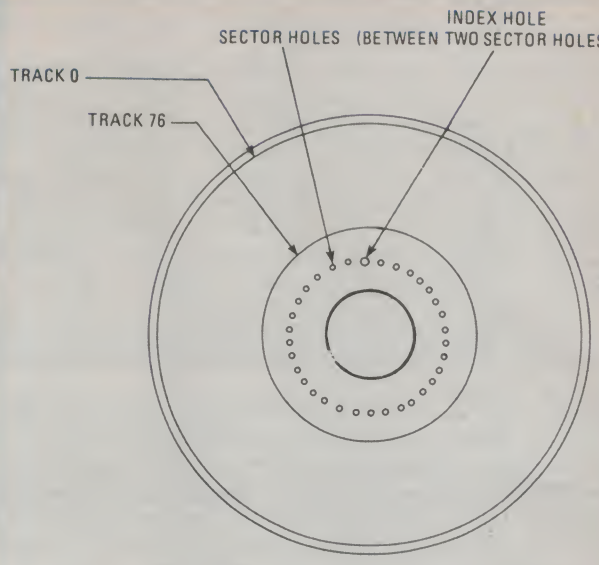


Fig. 4: Hard sectored disks use sector holes.

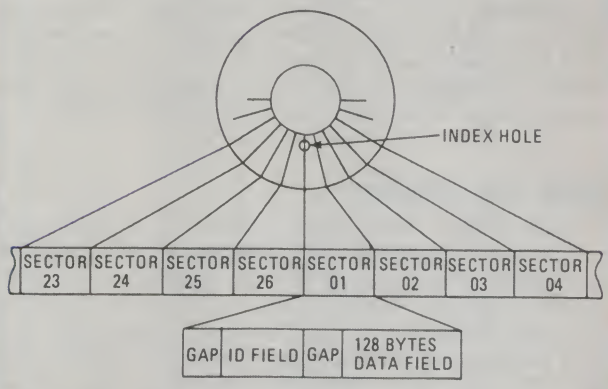
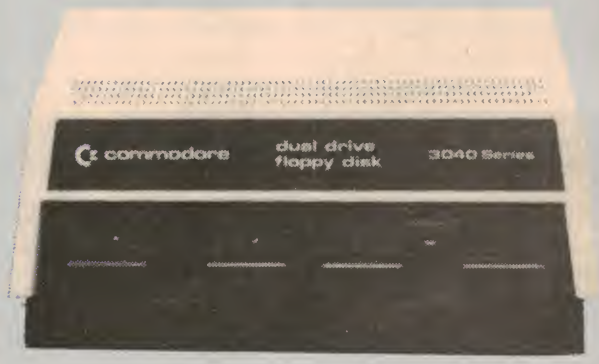


Fig. 5: The IBM 3470 format – standard for 8-inch disks.



Commodore 5¼-inch drives – a package offered by the computer manufacturer.

A 5¼-inch minifloppy diskette has an unformatted capacity of 110K bytes. With soft-sectoring, this figure drops to 80.6K bytes. The minifloppy diskette can be formatted with anywhere from 35 to 77 tracks and 10 to 16 sectors-per-track.

Single density, double density

Data is placed on a disk using frequency modulation (FM). A 250kHz clock generator produces pulses that repeat every four microseconds to form data cells on the surface of the Mylar disk. When writing data to the disk, if a data bit is supplied during the interval between clock pulses, a magnetic

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16K D RAMS	$1.25	4K STATIC RAM	$1.20	ITT EQUIVLNT PN2222 AND PN2222A	.08
32K E PROM	$4.00	CMOS CD4511	.75	SPEECH SYNTHESIS EVALUATION KIT	$90.00
SILICON RECT IN4005	.05	ITT EQUIVLNT PN2907 AND PN2907A	.08		

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SN74ALS00	.30
SN74ALS02	.30
SN74ALS04	.30
SN74ALS05	.30
SN74ALS08	.30
SN74ALS09	.30
SN74ALS10	.30
SN74ALS11	.30
SN74ALS17	.30
SN74ALS15	.30
SN74ALS20	.30
SN74ALS21	.30
SN74ALS30	.30
SN74ALS32	.30
SN74ALS33	.35
SN74ALS37	.35
SN74ALS38	.35
SN74ALS74	.40
SN74LS00	.14
SN74LS01	.15
SN74LS02	.15
SN74LS03	.15
SN74LS04	.15
SN74LS08	.15
SN74LS10	.15
SN74LS11	.15
SN74LS12	.15
SN74LS14	.15
SN74LS20	.15
SN74LS21	.15
SN74LS22	.15
SN74LS26	.17
SN74LS27	.15
SN74LS28	.17
SN74LS30	.15
SN74LS32	.15
SN74LS33	.15
SN74LS40	.20
SN74LS42	.27
SN74LS49	.45
SN74LS51	.15
SN74LS55	.15
SN74LS63	.99
SN74LS73	.20
SN74LS74	.17
SN74LS75	.27
SN74LS76	.25
SN74LS83	.38
SN74LS86	.15
SN74LS90	.25
SN74LS91	.29
SN74LS93	.25
SN74LS95	.29
SN74LS96	.35
SN74LS109	.19
SN74LS112	.19
SN74LS113	.19
SN74LS114	.23
SN74LS122	.23
SN74LS123	.23
SN74LS125	.23
SN74LS126	.23
SN74LS132	.15
SN74LS136	.15
SN74LS138	.23
SN74LS139	.23
SN74LS151	.19
SN74LS153	.19
SN74LS155	.26
SN74LS156	.26
SN74LS157	.21
SN74LS161	.26
SN74LS163	.26
SN74LS164	.26
SN74LS165	.34
SN74LS166	.34
SN74LS174	.23
SN74LS175	.23
SN74LS181	.90
SN74LS183	1.80
SN74LS189	1.80
SN74LS192	.37
SN74LS193	.37
SN74LS194	.29
SN74LS195	.29
SN74LS196	.35
SN74LS197	.29
SN74LS219	1.80
SN74LS221	.27
SN74LS240	.42
SN74LS242	.29
SN74LS243	.33
SN74LS244	.42
SN74LS245	.60
SN74LS251	.28
SN74LS257	.26
SN74LS259	.29
SN74LS261	.95
SN74LS266	.21
SN74LS273	.35
SN74LS275	2.45
SN74LS279	.23
SN74LS280	.29
SN74LS283	.29
SN74LS290	.23
SN74LS293	.26
SN74LS295	.33
SN74LS297	7.05
SN74LS298	.29
SN74LS299	.99
SN74LS323	.83
SN74LS347	.52
SN74LS348	.33
SN74LS366	.26
SN74LS367	.26
SN74LS368	.26
SN74LS373	.53
SN74LS374	.53
SN74LS375	.25
SN74LS377	.35
SN74LS378	.23
SN74LS379	.25
SN74LS382	1.37
SN74LS384	3.05
SN74LS385	.33
SN74LS386	.21
SN74LS390	.29
SN74LS393	.29
SN74LS398	.37
SN74LS399	.25
SN74LS422	.33
SN74LS423	.41
SN74LS440	2.30
SN74LS441	2.30
SN74LS442	2.30
SN74LS443	2.30
SN74LS444	2.30
SN74LS446	2.30
SN74LS448	2.30
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SN74LS490	.43
SN74LS541	.49
SN74LS600	2.75
SN74LS601	2.75
SN74LS602	2.75
SN74LS603	2.75
SN74LS604	2.75
SN74LS605	2.75
SN74LS606	2.75
SN74LS607	2.75
SN74LS610	19.50
SN74LS611	19.50
SN74LS612	19.50
SN74LS613	19.50
SN74LS620	.85
SN74LS621	.95
SN74LS622	.78
SN74LS623	.78
SN74LS625	1.15
SN74LS626	1.15
SN74LS627	1.15
SN74LS628	.85
SN74LS629	1.20
SN74LS630	38.70
SN74LS631	38.70
SN74LS640	.57
SN74LS642	.77
SN74LS643	.77
SN74LS644	.77
SN74LS646	3.40
SN74LS647	3.40
SN74LS668	.47
SN74LS669	.47
SN74LS670	.47
SN74LS674	6.20
SN74LS682	1.65
SN74LS690	1.50
SN74LS691	1.50
SN74LS692	1.50
SN74LS693	1.50
SN74LS696	1.50
SN74LS697	1.50
SN74LS698	1.50
SN74LS699	1.50

DIGITAL

SN74S00	.23
SN74S02	.23
SN74S64	.23
SN74S74	.41
SN74S86	.41
SN74S113	.41
SN74S133	.25
SN74S153	.61
SN74S163	1.60
SN74S174	.99
SN74S241	1.40
SN74S257	.65
SN74S258	.65
SN7400	.19
SN7402	.19
SN7404	.21
SN7405	.21
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SN7407	.25
SN7410	.19
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SN7475	.25
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SN7480	.39
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SN7486	.25
SN7490	.27
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SN7494	.41
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SN7497	1.35
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SN74121	.27
SN74122	.33
SN74123	.33
SN74128	.33
SN74132	.33
SN74136	.33
SN74144	2.05
SN74148	.55
SN74150	.88
SN74157	.29
SN74161	.47
SN74164	.47
SN74165	.47
SN74166	.47
SN74173	.50
SN74174	.40
SN74178	.68
SN74179	.68
SN74180	.47
SN74182	.50
SN74191	.47
SN74192	.45
SN74193	.45
SN74195	.33
SN74197	.51
SN74251	.51
SN74259	1.90
SN74279	.41
SN74283	.65
SN74284	1.80
SN74290	.49
SN74365	.35
SN74393	.83
SN75107	.68

LINEAR

SN75113	1.05
SN75114	.77
SN75115	.77
SN75116	1.48
SN75173	1.33
SN75188	.33
SN75189	.25
SN75452	.23
SN75461	.23
SN75473	.38
SN75492	.45
LM301	.16
LM307	.16
LM311	.28
LM317	.75
LM318	.67
LM324	.28
LM337	.95
LM339	.25
LM358	.23
LM3900	.30
MC1458	.25
MC1488	.30
MC3486	1.25
MC3487	1.25
NE555	.18
NE556	.35
RC4136	.55
RC4558	.20
TL188	1.02
TL430	.35
TL441	1.25
TL442	1.10
TL489	.44
TL490	.81
TL494	1.96
TL496	.50
TL497	1.00
TL505	1.70
TL507	.53
UA78L12	.19
UA709	.20
UA723	.20
UA741	.18
UA747	.31
UA748	.21
UA7805	.39
UA7806	.39
UA7812	.39
UA7815	.39
UA7912	.44
UA7915	.44

DIODES

1N459	.01
1N746	.01
1N747	.01
1N748	.01
1N749	.01
1N750	.01
1N751	.01
1N752	.01
1N753	.01
1N754	.01
1N755	.01
1N756	.01
1N757	.01
1N758A-10	.01
1N759	.01
1N914	.02
1N964	.01
1N965	.01
1N967	.01
1N968	.01
1N970	.01
1N973	.01
1N4735	.01
2N2222	.01

TRANSISTORS

TIP29A	.25
TIP29C	.33
TIP30A	.33
TIP31	.31
TIP31A	.23
TIP31C	.27
TIP32C	.31
TIP33	.49
TIP33A	.49
TIP33B	.49
TIP33C	.53
TIP34	.53
TIP34C	.90
TIP35C	1.02
TIP41A	.55
TIP41B	.36
TIP41C	.65
TIP42B	.37
TIP42C	.55
TIP49	.47
TIP50	.47
TIP110	.38
TIP111	.44
TIP112	.46
TIP115	.38
TIP120	.40
TIP122	.38
TIP125	.48
TIP141	1.15
TIP145	1.15
TIP146	1.15
TIP2955	.47
TIP3055	.49
2N3791	.40
2N5671	1.00
2N6328	1.00

BI POLAR MEM

SN74LS289	1.85
SN74S474	3.95
SN7482	.75
SN7489	1.60
SN74185	1.60
TBP18S22	2.75

OPTO

TIL31	.65
TIL81	.55
TIL112	.27
TIL113	.45
TIL116	.41
TIL138	.89
TIL149	.89
TIL153	.47
TIL209	.10
TIL220	.10
TIL232	.25
TIL286	.14
TIL302	3.00
TIL304	3.00
TIL306	5.50
TIL308	5.50
TIL309	5.50
TIL312	.75
TIL313	.75
TIL321	.75
TIL322	.75
TIL327	.75

SOCKETS (MACHINE)

L PROFILE SOLDER	
14 PIN	.85
16 PIN	.90
18 PIN	.95
20 PIN	1.00
24 PIN	1.20
40 PIN	1.50
64 PIN	3.50
L PROFILE W/WRAP	
14 PIN	1.50
16 PIN	1.70
18 PIN	1.90

SOCKETS (DIP)

WIRE WRAP	
8 PIN	.10
14 PIN	.17
16 PIN*	.20
18 PIN	.20
20 PIN*	.21
28 PIN*	.30
40 PIN	.42
EDGE GRIP PROFILE SOLDER	
8 PIN	.10
14 PIN	.17
16 PIN	.20
18 PIN	.20
20 PIN	.21
22 PIN*	.23
24 PIN	.23
28 PIN*	.30
40 PIN*	.42
FACE GRIP L PROFILE SOLDER	
8 PIN*	.10
14 PIN*	.17
16 PIN*	.20
18 PIN*	.20
20 PIN*	.21
22 PIN*	.23
28 PIN*	.30
40 PIN*	.42

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TIC116F	.81
TIC126D	.55
TIC246D	.70

MPU/CPU

TMS9902	3.20
TMS9981	12.50
HD6802	3.75
HD6821	2.10

OP AMPS

TL060	.35
TL061	.35
TL064	.99
TL066	.35
TL071	.31
TL072	.57
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transition will occur as the read/write head contacts the oxide surface of the disk; that corresponds to a logic 1. If no data bit is sent, there will be no magnetic transition and thus the oxide is unchanged, representing a zero, as shown in Fig. 6.

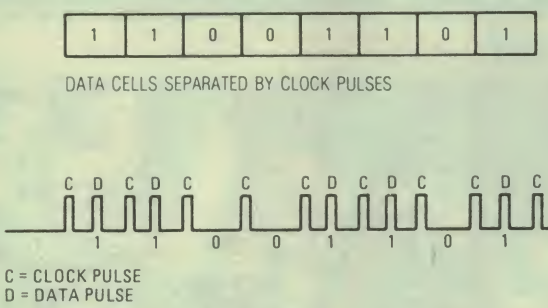

Fig. 6: A frequency modulation system is used for single density recording.

When reading data from the disk, the stream of pulses would include the 250kHz clock pulse and pulses representing ones and zeros. When a data cell includes a clock pulse and a data pulse, the presence of the two pulses identify a logic 1; the presence of only the clock pulse indicates a logic 0. That encoding technique is called FM encoding and is commonly referred to as single-density.

With FM encoding, the IBM 3470 format specifies a recording density of 3408 bits-per-inch. Thus, with 77 tracks, 26 sectors, and 128 bytes-per-sector, a total of 256,256 bytes can be stored on a single-sided 8-inch disk.

To double the storage capacity, a double-density technique was developed based on an MFM (Modified FM) encoding. Basically, many of the clock pulses are removed and the presence of a pulse signifies a logic 1 while the absence represents a logic 0. Synchronisation is accomplished by inserting a clock pulse at certain intervals. By eliminating many of the clock pulses, more room for data is available within each sector and twice as much information can be stored on a given length of track using MFM encoding rather than FM. Of course, there is a tradeoff . . . more sophisticated pulse-circuitry is required for clock timing and data writing.

Other techniques have been developed to increase the storage capacity of disks even farther. One scheme involves the use of drives with two read/write heads, one for each side of the disk. Thus, data can be stored on both sides of the disk. Some manufacturers have even introduced a quad-density recording technique that they claim will offer four times the storage capacity of a single-density drive.

Table 1 lists the unformatted storage capacity for both 5¼ and 8-inch disks using various data storage techniques. As shown, a single-sided single-density minifloppy (5¼ inch) provides 128,000 bytes of storage capacity while a double-sided double-density 8-inch disk provides almost two megabytes. In practical terms, a single-sided minifloppy would hold the equivalent of 30 single-spaced typewritten pages while the 2-megabyte capacity of a double-sided double-density 8-inch floppy could hold as many as 400.

Those storage capacities, however, are for unformatted disks. After the disk is formatted, the data-storage capacity decreases depending on the formatting technique used. The actual storage capacity of a double-density 8-inch disk formatted with 77 tracks and 26 sectors-per-track is around 1.1 megabytes. A dual-drive, double-density, double-sided 8-inch disk drive system can store over two million bytes.

Obviously, the added capacity of the double-sided double-sided double-density technique is a definite asset. However, drawbacks include the lack of standardisation. Thus, a double-density diskette prepared on one system very often cannot be used with another disk system. Double-sided drives also have a drawback. Here, two read/write heads are used – one acting as the pressure pad for the other. Excess head wear and/or diskette damage is more likely to occur than with single-sided systems.

Access time and transfer rate

In addition to storage capacity, access time and transfer rate are important specifications for a disk drive. Access time is the time it takes for the drive to access data in a random manner. Thus, the access time depends on the time it takes for the read/write head to arrive at the proper track (track-to-track seek time) and then wait for the data in the proper sector (latency time). Specifications for disk drives generally list an average access time derived by using one half the unit's poorest access time. Maximum, or worst, latency time is when the read/write head arrives at the proper track just as the correct sector passed by. In that case the head must wait for a full rotation of the disk and thus produces the maximum delay.

Typical average track-to-track seek times vary from 3ms to 100ms for an 8-inch disk drive and 3ms to 25ms for a 5¼-inch disk drive. Latency time (average) for an 8-inch drive is about 85ms and about 100ms for a minifloppy. Total access time for an 8-inch drive might range from 150ms to 300ms and about 400ms to 600ms for a minifloppy.

The transfer rate, or speed at which the disk drive can transfer its data to the computer, is another measure of disk-system performance. Obviously, a quick access time and rapid transfer rate means the computer can start to perform its operations with less time wasted. Typically, a single-sided minifloppy can transfer data at a 15 kilobytes-per-second rate and at twice this speed with double-density techniques. An 8-inch disk can transfer data at typical rate of 62.5 kilobytes-per-second, although models are available with transfer speeds as high as 125 kilobytes-per-second.

Disk-system components

So far we've talked about the floppy disk and the disk drive. However, a complete floppy-disk system consists of more components, as shown in Fig. 7. So, let's list all of the components that make up a complete disk system.

5¼-inch Floppies			
Type	**Sector Type**	**Unformatted Storage Capacity (Kilobytes)**	**Transfer Rate (Kilobytes Per Second)**
Single-density/ single-sided	Soft	128	15.6
Single-density/ dual-sided	Soft	256	15.6
Double-density/ single-sided	Soft	512	31.2
8-inch Floppies			
Single-density/ single-sided	Soft	400	31.2
Single-density/ dual-sided	Soft	800	31.2
Double-density/ single-sided	Soft	800	62.4
Double-density/ dual-sided	Soft	1,600	62.4

Table 1: Storage capacity for various disk formats.

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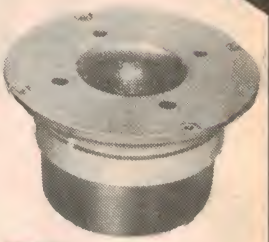

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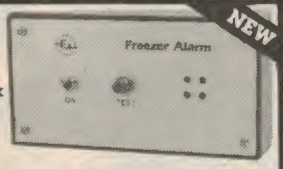

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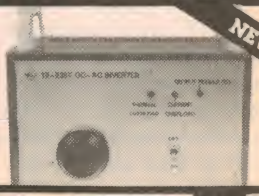

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Floppy disk drives

1. The floppy disk itself.
2. A disk-drive assembly to rotate the disk and position the read/write head to the desired track position. Inside the cabinet that houses the drives is a power supply to provide the operating voltages to power the drives.
3. A disk controller to specify head position, control the drive motor, check and correct errors, and perform other functions.
4. Interface circuits to connect the computer control-signals properly to the disk controller.
5. Programs (software) to control the operation of the disk drive, such as specifying to which track and sector of the disk data should go, handling the actual reading and writing of data, and monitoring that the data transfer is correct. Those programs are called disk-operating systems (DOS's) and they operate with a file management system (FMS) to identify files of data and route data to individual tracks and sectors on the disk.

The disk controller has the responsibility of read/write head positioning, sector identification, disk-motor control, head loading and unloading, error detection and correction, and of controlling the transfer of data to the interface circuits between the disk drive and the main computer. In most instances, the interface board contains the disk controller circuitry. This board mounts inside the computer and is connected to the disk drive(s) by a ribbon cable.

The disk-operating system (DOS) controls the operation of the controller circuitry. It resides on a floppy disk. One of the functions of the DOS is to transfer data and programs between the computer and the floppy-disk system. Thus, when you first turn on the computer system, it is necessary to load the DOS from the floppy disk into the computer. That task is handled by a short program called a bootstrap loader. The bootstrap loader is contained in a ROM, usually on the interface board. Depending on the computer system, the bootstrap program is called up by a simple keystroke on the computer's keyboard. Once the system has been "booted", the computer and floppy-disk system are ready to accept operator commands. The DOS takes care of labelling the files, editing, error detection, and file copying. A file-management system designates the track and sector allocations on the disk for files.

Since the DOS occupies a rather substantial portion of a diskette, a system with only a single floppy-disk drive is rather limited. Thus, it is common for packaged computers, such as those offered by Radio Shack, Apple, and others, to include two or more floppy-disk drives. One disk controller can generally handle several disk drives.

After the diskette is inserted through the front door of the floppy-disk drive and the door is closed, the drive spindle grips the centre of the diskette and the motor brings the disk up to full rotational speed. The DOS directs the controller circuitry to position the read/write head to track 00 and the index hole, in conjunction with an optoelectronic sensor, generates a location pulse for timing. As the floppy disk spins, the heads are carefully positioned above the desired track. Then, the read/write head is pressed against the oxide coating with the help of pressure pads on the opposite side of the disk. That is called "head loading" and it is directed by the DOS. When a different track is desired, the read/write head is unloaded (lifted off the surface of the disk), moved to a different track, and loaded once again.

Before the read/write head is actually loaded, a sensor inside the drive senses the write-protect notch and determines whether the floppy disk can be written to. Of course, during a read operation, the notch is not sensed. When the read/write head is loaded, a LED on the front panel of the drive alerts the user that the drive is in operation and the disk should not be removed. When the drive completes its operation, the read/write head is unloaded, the LED goes out, and the disk may be removed.

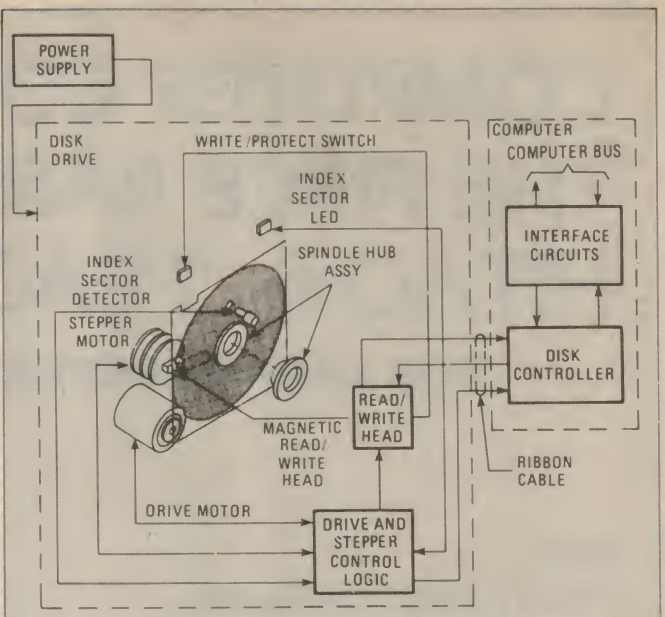

Fig. 7: Components of a floppy disk drive system.

5¼-inch disk drive packaged with power supply. (Photo courtesy of Dick Smith Electronics Pty Ltd).

Just as a computer is useless without proper software, so, too, is a disk drive. A well-prepared disk-operating system (DOS) is required to keep track of what is stored on the disk, and where it is located. The DOS handles such tasks as transferring programs from one device to another, locating read/write errors, providing a means to make backup copies of a diskette, and other chores.

Although basically similar, most DOS's are unique in their own way, and vary from one manufacturer to another. The DOS must be configured for the particular computer system it is to be used with. Also, if you decide to buy software on disk, the software must be compatible with the DOS. That condition also includes high-level languages such as BASIC.

Disk errors

Disk errors are categorised as either soft or hard errors. Hard errors are caused by defects on the disk surface; soft errors are due to program or processing troubles or power-line tran-

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sients. An example of a soft error is what is commonly called a seek error, which occurs when the read/write head appears at the wrong track. Part of the disk-controller's job is to locate and correct those disk errors. For example, the disk controller will compare the track being read with the track number that was called for by the DOS and determine whether a discrepancy exists. If a deviation is noted, the disk controller will initiate a new positioning routine.

A soft error is also classified as a recoverable error, one that the disk controller can spot and (sometimes) correct. A hard error is a non-recoverable error; the controller can detect it but cannot correct it.

It is estimated that a soft-sector disk system has an error rate of one per 108 bits during a read operation; one per 1011 bits during a read operation is the estimate for a hard-sectored disk. Under normal usage a disk is expected to last about two years; a track is considered to be worn or defective when its output level drops to 20% of its original value.

Is a backup copy necessary?

A backup is an exact duplicate copy of a disk. A backup copy is almost mandatory since it can be expected, sooner or later, that a disk will become defective due to wear, or dust contamination, or possibly due to the read/write head's damaging the oxide coating of a disk. When that calamity occurs, and a backup copy has not been made, it will be necessary to reconstruct the lost information (if still available) and prepare a new disk.

How critical the data is, how often it changes, and how costly the loss will determine how frequently a data backup copy should be made. Large investment houses or banks might back up data every hour; small-business users perhaps only once a week. To make creating backup copies convenient, the DOS usually contains a command for duplicating disks.

Selecting your disk drive

Computers and their peripherals are costly. So selecting a computer, printer, disk drive, or other accessory demands a hard look at the future, as well as the present. Among the questions to be answered are: What capacity do, and will, you need? A novice, or someone interested in games, can possibly be content with a cassette system and need not invest in a floppy system at all. Others, requiring a mass-memory storage capacity of, say, 250K bytes may settle for a single-drive unit — bearing in mind that an 8-inch disk holds twice as much data as a 5¼-inch diskette at less than double the cost. Generally, a single disk controller and DOS can operate up to three drives; thus it is common to start with a minimum investment and gradually add more drives to it.

Is the disk-drive hardware and software you have selected compatible with your computer? Your computer, keyboard, printers, and display must interface with the disk-system's electronics and DOS. Is the software you intend to use available for the disk system you are about to purchase? How important to you is access time and data transfer rate? Is size critical? Are there any unusual environmental considerations?

And, of course, there are basic considerations that must always be evaluated. How long has the manufacturer, whose units you are considering, been in business, what is his reputation, what is his warranty policy? Are there local places for service or must units be shipped back to the factory? Will spare parts be readily available? Also, it's wise to ask dealers and members of computer clubs about the experiences with the models you are considering. Do they have a good record in their field? Don't hesitate to ask questions before the final purchase . . . once you've bought the disk system, you'll be tied to it for a long time.

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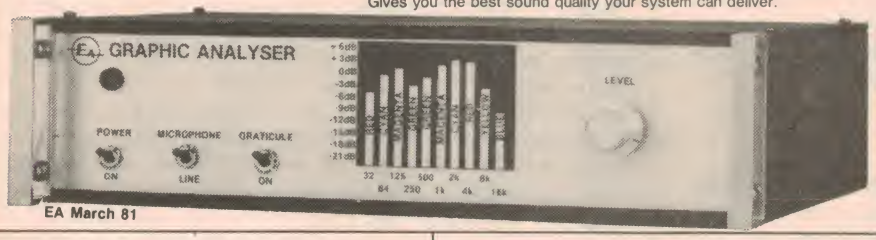

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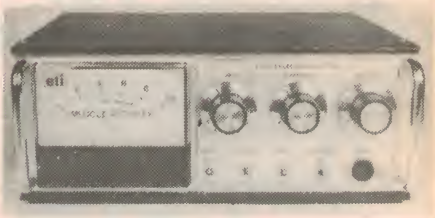

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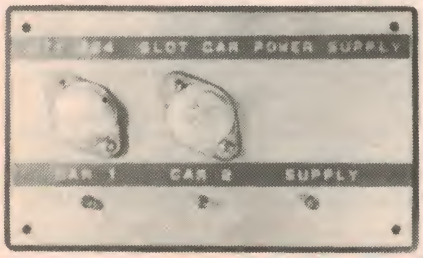

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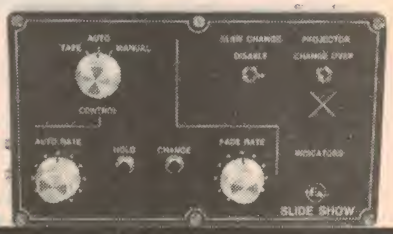

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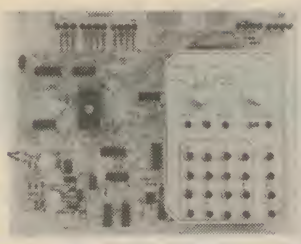
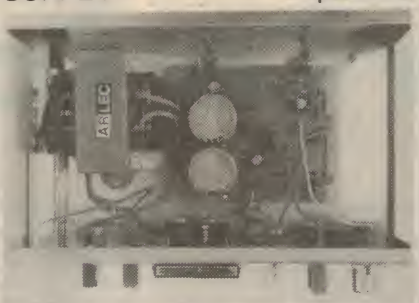
$39.50



No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.

With Textool Sockets $51.00
EA January 82

DUAL TRACKING POWER SUPPLY **$83.50**



Built around positive and negative 3-Terminal Regulators, this versatile dual tracking Power Supply can provide voltages from ±1.3V to ±22V at currents up to 2A. In addition, the Supply features a fixed +5V 0.9A output and is completely protected against short circuits, overloads and thermal runaway. **EA March 82**

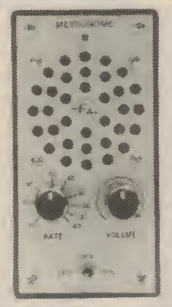
SOUND TRIGGERED FLASH **$26.50**

This easy to build sound or light operated flash trigger has many feature.

Catch those spectacular and humorous moments like that time your mother-in-law slipped on the moss covered patio and broke her neck. **ETI 568 October 80**

ELECTRONIC METRONOME

$16.90



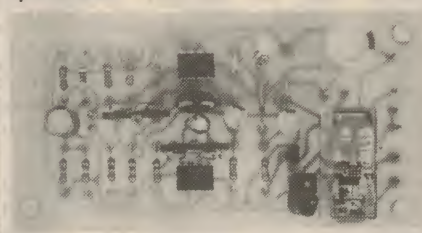
Great new Metronome Circuit with low current drain (less than one milliamp) drives a Loudspeaker and a Led Indicator. **EA January 82**

"LE GONG"

$14.95

The "Le Gong" Doorbell with those unmistakable chimes generated by the LSI. A must for the man who has everything! **EA February 81**

VOICE OPERATED RELAY **$14.95**



EA's great new Voice Operated Relay can be used to control a tape recorder, as a VOX circuit for a transmitter, or to control a slide projector. **EA April 82**

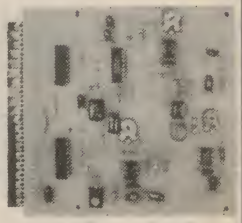
3½ DIGIT LCD CAPACITANCE METER

Handy pocket size Digital Capacitance Meter, runs off a 9V battery and measure 1pF to 19.99uF in just three ranges. **EA March 82**

$69.00

LED LEVEL METER

$27.00



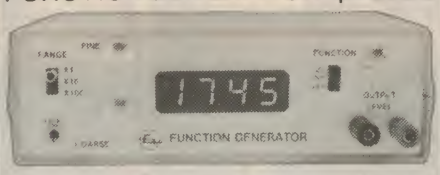
Build a Led level Meter with simultaneous peak and average display plus 60dB dynamic range. This kit is ideal for any application requiring a wide dynamic range level display. **ETI 458 June 81**

DIGITAL THERMOMETER: 3½ DIGIT LCD

$69.00

Measure temperatures from below freezing point to around boiling point. **EA February 82**

FUNCTION GENERATOR **$79.50**



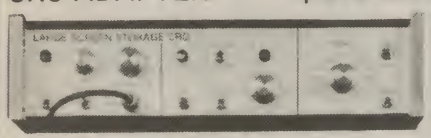
This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160kHz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting. **EA April 82**

LOTTO/POOL'S SELECTOR

$22.50

You have to be in it to win it . . . Take the chance out of winning the Pools as well as Lotto, and build the great new Pools/Lotto Number Selector. **EA July 81**

LARGE SCREEN TV STORAGE CRO ADAPTER **$109.00**



For a low cost Storage CRO with Synchronised Display, Flectronic Graticule, One-Shot Triggering and Optional Storage of up to four Screen Displays it can't be beaten. **EA February 82**

LOW OHMS METER **$34.50**

How many times have you cursed your Multimeter when you had to measure a low-value resistance. Well alas, with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms. **ETI 158 November 81**

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$59.00

"Electrotune" . . . no its not for your car It's a 23-note Organ with Special Effects. Singalong with this fun to build Organ and amaze the family and neighbours like never before. **EA July 81**

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$29.00

Have great fun creating your own recording effects with music and voice. The Sound Bender can receive from Electric Guitar, Microphones, etc. **ETI February 82**

300W AMP MODULE **$63.00**

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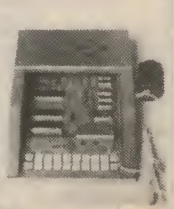
ETI 660 WITH OPTIONS



Kit inc PCB, ICs, Skts	**$99.00**
Colour Option	**$13.50**
Video Modulator In	**$14.50**
Plugpack to Suit 8VAC/1A	**$11.95**
Set of 4 (2114 Rams) 3K Upgrade	**$17.00**
18 Keys plus Scotchcal Labels	**$29.00**

ETI October 81

An English design based on a custom microprocessor

Voyager Car Computer

Following hard on the heels of EA's car computer project published in July, August and September, 1982, is the fully assembled Sparkrite Voyager which is made in England and sold in Australia by Jaycar Pty Ltd. It is very well designed and presented and is supplied with a full installation kit.

by LEO SIMPSON

When we first saw the Sparkrite Voyager car computer, we were "cheesed off" to say the least. After the many frustrating months spent in the development of our own Car Computer based on readily available electronic components we were now faced with a commercial unit which seemed to offer all the features of the EA unit and a few more to boot.

Euphemistic expressions such as "Aaarggh!!" and "Gad" and "Pon my soul" were heard to be uttered in the EA office.

Having made these unofficial sounds, an official reaction had to be delivered to the people from Jaycar. Accordingly, we dropped the whole into the nearest wastepaper basket and proceeded to forget the whole matter. At least, that is what we would have liked to do. Having lived with our pet project for so long and having finally seen it come to fruition, we wanted little to do with this interloper.

Naturally, good sense prevailed and we meekly agreed to review the Voyager. In any event, we had to acknowledge that while our Car Computer has generated a great deal of interest, there are probably quite a few readers who would wish to purchase a fully assembled unit at some extra cost.

And so it was that your Editor found himself spending a pleasant late winter's day installing the Voyager on his ancient but much-loved 1973 Kingswood. In fact, some of the EA wags were heard to make sly comment about the proposed installation "doubling the value of the Kingswood".

These idiots were ignored.

The presentation of the Voyager is such that it should blend well with the interior styling of most cars. The external housing is a low-sheen black finish which will match the vinyl upholstery found in many later model cars. Similarly, the gold finished buttons and highlights on the control panel will certainly not look out of place.

Anyone considering purchase of the Voyager will almost certainly be familiar with the EA Car Computer and will inevitably draw comparisons. We will proceed with this assumption in mind.

Sixteen pushbuttons and a three-position slide switch control the Voyager. The four immediately underneath the five-digit display are used for calibration and time-setting while the other 12 are set in four columns each of which is headed under one of the four titles: Log, Now (meaning instantaneous), Trip and Alarm.

The three buttons in the LOG column are fairly self explanatory: Distance, Fuel and Average Consumption. These are overall values since the computer was last reset which would normally be done at the beginning of a long holiday journey or when the fuel tank is filled.

Similarly, the buttons in the NOW column are explanatory and give instantaneous values for Speed, Time (12-hour) and fuel consumption. The TRIP buttons are Speed (average for a trip), Time (since starting the trip) and Distance (to the present time). Speed and Time alarm functions are also provided.

Fuel tank range and time remaining functions, as featured in the EA computer, are not provided.

No less than six small incandescent lamps provide illumination of the control buttons just mentioned but there are no LEDs (as on the EA job) to show which function is currently being displayed.

In appearance, the Voyager looks considerably more compact than the EA unit but the actual measurements indicated that the only real difference is in the

The Voyager car computer can display fuel consumption in three ways: Miles/gallon, miles/litre and litres/100km.

depth and this may or may not be an advantage, depending on the actual installation. Dimensions are 200 x 70 x 90mm (W x H x D) but the practical depth will depend on the mounting arrangement used.

There is a subsidiary "heatshield" inside the main case so that even if the unit is subject to direct sunlight, the electronic componentry should not overheat. Even so, I am not sure that I would like to see the unit exposed continuously to Australian sunlight on the dashtop of a closed car. I have seen what that can do to tape cassettes. Imagine what a Salvador Dali painting of cassettes would be like and you have a good idea of what happens.

Inside, the circuitry is contained on a sandwich of two double-sided PC boards. One board carries the 16 pushbuttons and six incandescent lamps and clips to the other with the aid of a two-way and a 13-way connector. The main board carries seven ICs, a three-terminal regulator and 13 transistors.

The 40-pin microprocessor chip is a dedicated Motorola device, with mask-programmed ROM plus RAM, with a power down feature for some of the RAM. The clock is derived from a 4.194304MHz crystal which is built around a 4521 oscillator and 24-stage divider IC. This IC gives one-second pulses for the various housekeeping functions.

The keyboard is connected directly to the data lines of the microprocessor while the fuel and distance sensors are interfaced via a quad op amp IC for signal amplification and shaping.

The five-digit vacuum fluorescent display is multiplexed and interfaced to the address lines via octal buffer ICs. Also connected to the address bus is a 144102 RAM Chip. High voltage and heater supply for the vacuum display is provided by a ringing-choke inverter using a potcore transformer.

The audible alarm device is a piezoelectric device made by Toko, Japan. The only other high-technology component is the 10-lead monolithic resistor array which is adjacent to the microprocessor.

Clearly, the Sparkrite Voyager design points up the advantages of a custom-designed microprocessor with mask-programmed ROM over the EA design which uses readily available chips. The advantages translate to a design with one major chip instead of three, and a smaller PC board. On the other hand, in justification, the EA design was produced with the average hobbyist in mind, who may even want to "burn" his own ROM. Certainly, all the bits and pieces for the EA job should be available for quite a few years to come.

One cannot help but be impressed with the completeness of the installation kit for the Voyager. It arrives well packed in polystyrene foam with full instructions. There is a comprehensive installation instruction sheet, an operating manual and a circuit diagram. A number of different mounting options are possible for the computer itself while a full set of hardware is provided for the sensors.

Installation

The fuel sensor is a turbine with an optical pickup, very similar to the EA transducer. It is supplied with plastic tubing and plastic fuel pipe clamps, adaptors and a T-piece. Installation was a fairly straightforward process although I unfortunately had to completely remove the fuel pump because the brass union was "frozen" onto the steel fuel pipe. Resealing steel fuel pipe connections against slow fuel leaks is a problem too but teflon tape wrapped around union threads is an effective solution.

I also used a number of small nylon cable ties to keep the wiring within the engine compartment neat and tidy. These were not supplied but can be purchased cheaply enough.

The speed pickup device is a coil with a thousand turns and a bolt through the centre which is positioned within 50mm of magnets strapped to the drive shaft. Four magnets are supplied. Four are used for a front-wheel drive installation (or rear engine) and two for a conventional rear drive car. Each magnet is held in a plastic saddle arrangement which has a loop through which is passed a long nylon cable strap. This holds the magnets very securely.

After some days of using the computer I found that I had made a mistake in installing the magnets. This was annoying since it had seemed straightforward enough at the time. In fact I had made two mistakes. First I had used four magnets instead of two and I had passed the strap underneath the magnets rather than over them. The result was that two of the magnets were flung off while driving at 80km/h. This immediately gave rise to readings of half actual speed and twice actual consumption, which was a little unnerving.

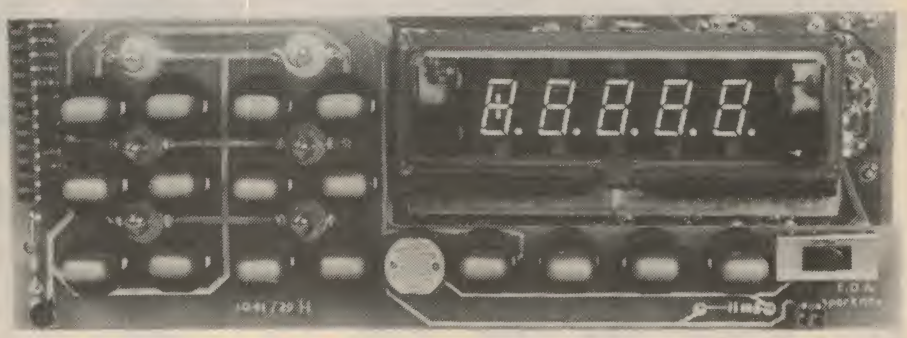
I immediately concluded (having realised what had happened) that the saddle arrangement was a poor design feature and it was not until I later consulted the installation diagrams that I realised my mistake (fool). I tell this story merely to emphasise how easy it is to make a mistake.

The hardest part of the whole installation was drilling a suitable hole for the wires through the engine compartment bulkhead. The manufacturers suggest a ½-inch hole and supply a grommet to fit but few domestic electric drills will take a bit of this size. I used a ⅜-inch drill and fitted a suitable grommet. You have to pick the site fairly carefully too, to avoid pipes and cables. Unfortunately, the spot I chose to drill went right through a gusset which must have been 3mm thick and seemed especially tough, probably because it was a welded section. If only I had been 2cm to the right . . .

Electrical connection

Voyager supply a number of Scotchlok connectors for breaking into the automotive electrical system without cutting and stripping wiring. This has a considerable advantage in that they are quick and easy. However, my car uses Utilux quick-connect terminals on the rear of the fuse panel so I elected to use more of these to facilitate easy removal of the computer wiring if need be. Voyager also supply two inline fuseholders which use solderless connections and so are very easy to install.

As mentioned before, there are a number of mounting options for the computer itself. Most of these make use of a double ball-joint system which allow the computer to be held in any attitude to suit the driver. One arrangement even allows the system to be console mounted on top of a swan-neck which looks very jazzy. Each mounting system involves the use of a slide-in foot assembly. This together with a 13-way connector (which is clearly labelled



The keyboard and mainboard are sandwiched together by connectors at each end. Six incandescent lamps illuminate the keyboard during night driving.

"wrong way" to indicate incorrect polarity – very thoughtful) facilitates quick and easy removal.

In fact, on reflection, the Voyager is far too easy to remove. Will it represent the prime "burglar bait" for 1983? I intend to install the unit more permanently "in dash" to reduce this possibility and make the unit less visible to sharp-eyed and nimble-fingered pilferers.

Driving experience

How did it go in actual use? Well, every function worked without any hitch although one must avoid the temptation to look at the display when traffic conditions are heavy. The range of fuel consumption figures is just as wide as would be returned by the EA car computer. For example, consumption can rise to 60 or 70 litres/100km when accelerating heavily and rise to ridiculous figures in the high hundreds when coming to a complete stop.

There is a small delay after the ignition is turned on before the computer display lights up. This is probably due to the thermal lag in the heater for the vacuum fluorescent display. Strangely, the display is actually green but it has been fitted with a red filter which renders it orange and somewhat less attractive than it otherwise would be. I think a green filter would have been better.

The brightness of the display is controlled by an LDR. This seems to work well since I was not at all conscious of its operation. Even so, in strong sunlight (coming in from the side of the car) the display is unreadable (as is the LED display in the EA car computer). That is another point that needs to be considered in installation – how to best shield it from ambient light.

The high voltage inverter does make a buzzing sound while in operation but this is not obtrusive and most drivers would probably be unaware of it.

One point that I did find offputting was the dash to the left of the numerals when indicating fuel consumption. This always looked like a minus sign to me so there tended to be a mental double-take every time I glanced at the display. I must also admit to finding the metric units for fuel consumption much easier to mentally absorb while driving. When you put your foot down you expect a numerically higher figure and that is what you get.

I tried using the "MPG" function as an alternative to "litres/100km" and found that did not make sense when driving as it is an inverse function. And I say that even though I must admit to converting back to MPG from metric units when I calculate consumption figures.

The third option for fuel consumption, "miles per litre", is just too silly for words. Not only is it an illogical mixture of units but it gives values which are silly, as I found when I switched across to it inadvertently while driving.

There is certainly no doubt that a car computer such as this can be a worthwhile aid to economical driving habits, provided you take notice of the display. I was surprised at just how frugal a big six-cylinder car with auto transmission can be when driven at light throttle settings. Figures around 8 litres/100km (35mpg) could be readily achieved by "driving with an egg under your foot" without holding up traffic at all but aggressive "cut-and-thrust" driving is precluded. Not a bad thing at all.

With consistently careful driving, following the feedback provided by the computer, the average driver who covers around 16 to 20,000 kilometres per annum could well recover the cost of this car computer inside two years.

To be realistic though, the digital display is not the most appropriate medium to illustrate this useful feedback. An analog display would be more useful most of the time as the driver is more interested in the trend of fuel consumption rather than the absolute values. Ideally, a computer should give both analog and digital displays so that there is little need for the driver to divert his attention from the road.

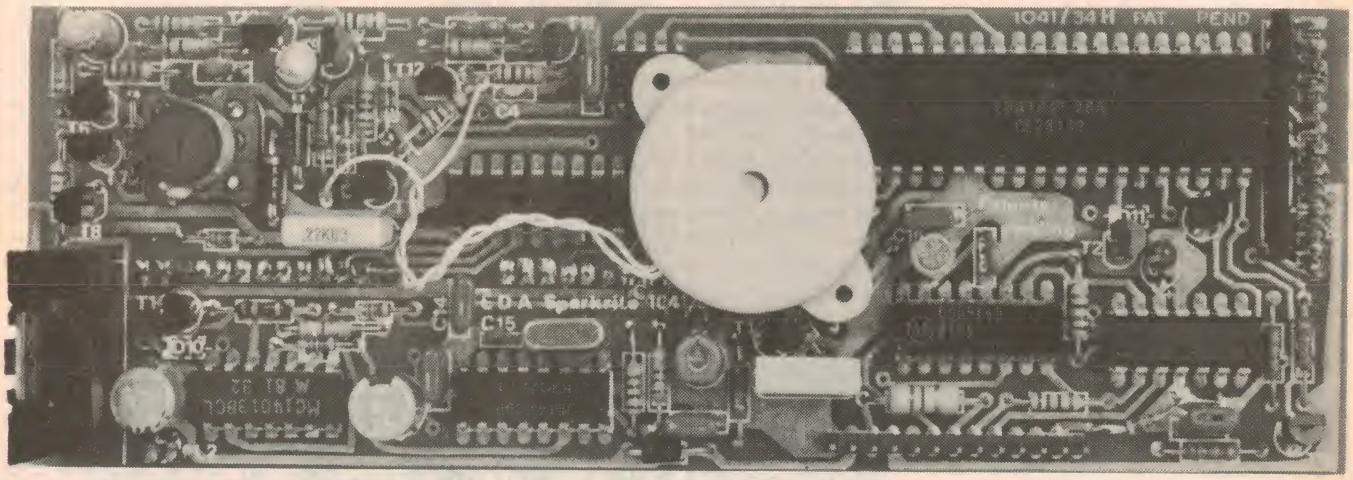
I have not used the time or speed alarms but they could be useful on a long trip, particularly the speed alarm. The headlight alarm is very good,with its six-chime warning which is effective without being too insistent or annoying.

A very good feature of the Voyager concerns what might be called an "interrogate" facility. Even with the ignition off, you can wake up the computer by pressing any of the Log, Now or Trip buttons for more than one second. The computer will then light up for six seconds to show the time or whatever. Very handy. But if your kids happen to touch the buttons while you are out of the car, and the ignition is off, they cannot accidentally reset any of the parameters held in memory.

All in all, I was impressed. A great deal of thought has gone into the production of this unit and most electronic enthusiasts should have no real problems in making a neat and tidy installation (no more than I did, anyhow). In their advertisement Jaycar state that the typically competent EA reader would do the installation in three to four hours. As a non-typical (dare I say competent?) example, I took the best part of a whole day. Sure, someone with experience of a few installations would probably only take an hour or so, especially if the car could be put on a hoist.

Anyone who opts to pay $39.50 for a complete installation will get good value for money and without any grease under the fingernails or barked knuckles.

Similarly, at $199 fully assembled and tested, the Sparkrite Car Computer must be rated good value for money. It is a difficult choice: build the EA job or buy the Sparkrite? (L.D.S.)



The component side of the main Voyager board: The custom microprocessor is at top right and the large disc is the piezoelectric alarm.

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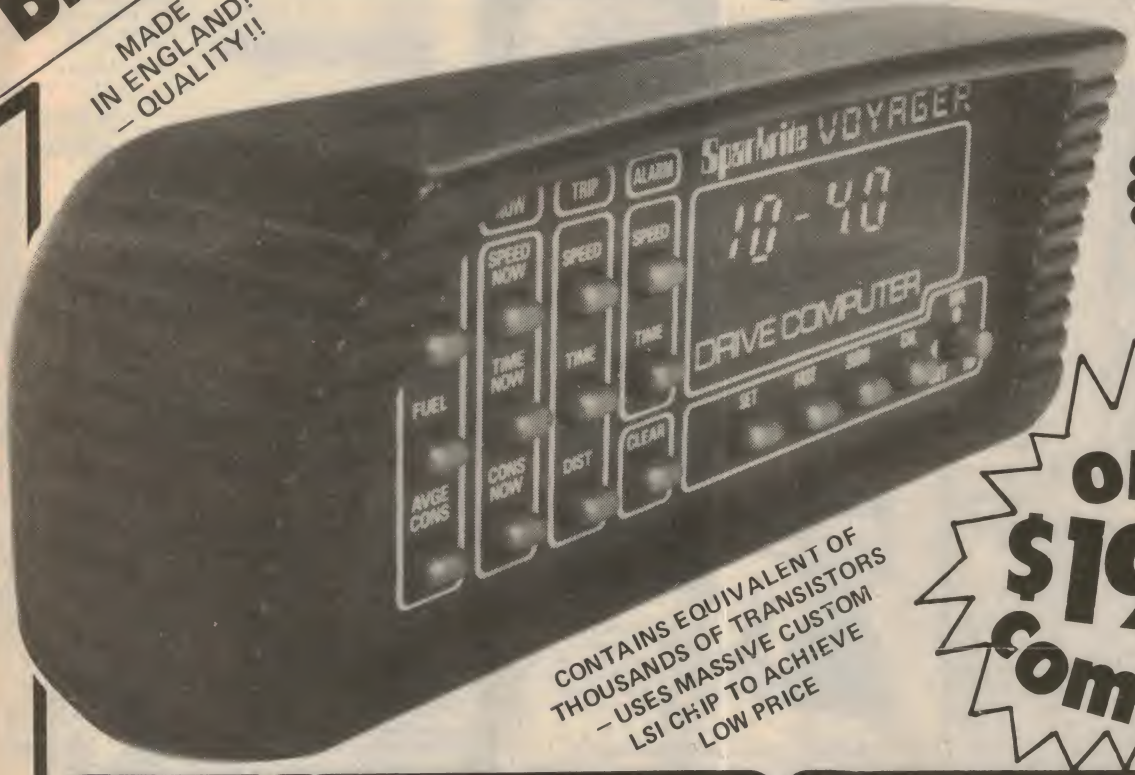

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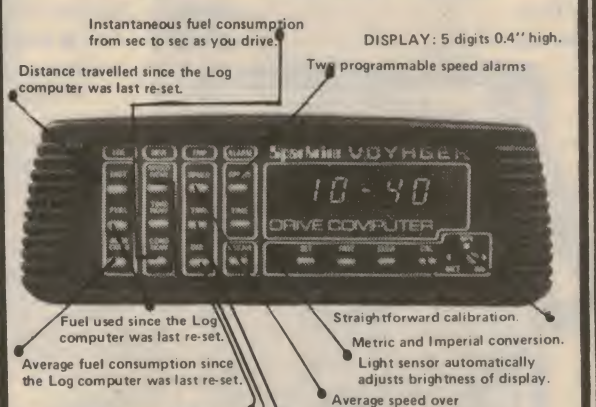
- INSTANT FUEL CONSUMPTION IN LITRES/100KM AND MPG!! (MOST OTHERS HAVE ONLY ONE OF THE ABOVE) JUST SWITCH FROM ONE TO THE OTHER AS YOU DRIVE ALONG.
- INSTANT SPEED, TIME AND OTHER FUEL DATA.
- VISUAL AND AUDIBLE EXCESS SPEED ALARM.

INSTALLATION

The "Voyager" comes complete with an unbelievable array of mounting configurations, on dash, under dash or stalk mount. ALL installation hardware is supplied (even a roll of insulation tape!) as well, of course, as the speed and fuel sensors. A lavishly illustrated installation manual is provided as well as a comprehensive operators manual. If you do not want to install the unit yourself we can do this for you for a guaranteed $39.50*. (A few exotic cars excluded!). A typically competent EA/ETI reader would do the job in 3-4 hours.
* Sydney metropolitan area only.

VOYAGER OPERATING FEATURES



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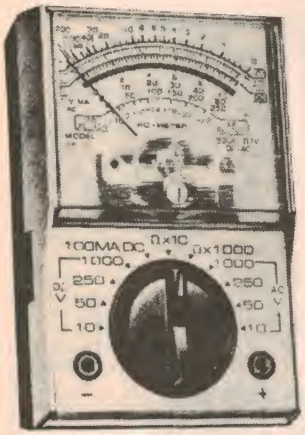

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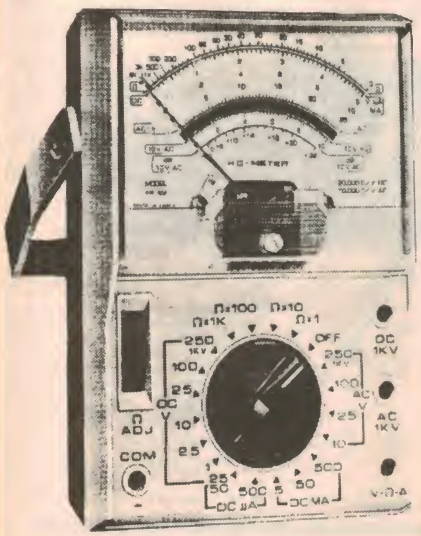

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FORUM

Conducted by Neville Williams

What do you expect of a personal computer?

Before investing in a new motor car, a wise person will give due consideration to a whole range of factors: price, size, comfort, road handling, reliability, economy, re-sale value, and so on. One may have to accept certain limitations, consciously and with good grace. But I wonder whether the same degree of perception is brought to bear in the purchase of a personal computer.

This complete departure from recent themes in "Forum" was triggered by a letter from M.L. in Cairns, Queensland, who also signs himself "EA 2650 owner".

The letter was headed: "Please publish! Do you have the courage?"

Perhaps I should observe that challenges to an editor to publish or publish "unaltered" have little practical influence on the fate of a letter. If the contents are timely and appropriate, they will receive favourable consideration; if they are not, the space will more likely be allocated to someone else's effort, challenge notwithstanding.

As it transpired, M.L.'s letter did give us reason to stop and think – although not involving the degree of trepidation that he seems to have anticipated. After a preliminary inquiry about another matter altogether, he takes up his main theme:

M.L's PROBLEM

As you have published quite a few build-it-yourself computer projects, 2650/Dream and now the Super-80 computer, I was wondering when the immoral practice of publishing these projects will cease.

The immorality could be tolerated if you published the following warning with each project: "Professional programs are not available for this project. It is not compatible with ready bought computers using the same CPU".

As I have since found out from a retired professor in electronics, the 2650 chip was originally developed for intelligent terminals and many firms had overstocked this item. So I am wondering if you were paid to shift dead stocks.

I had to stop and think because, although digital history, for us, covers little more than a single decade, a great deal has happened in that time and one tends to forget the context. Some of what M.L. has to say must be looked at against an historical background, rather than through the eyes of October 1982.

We can all be very wise after the event!

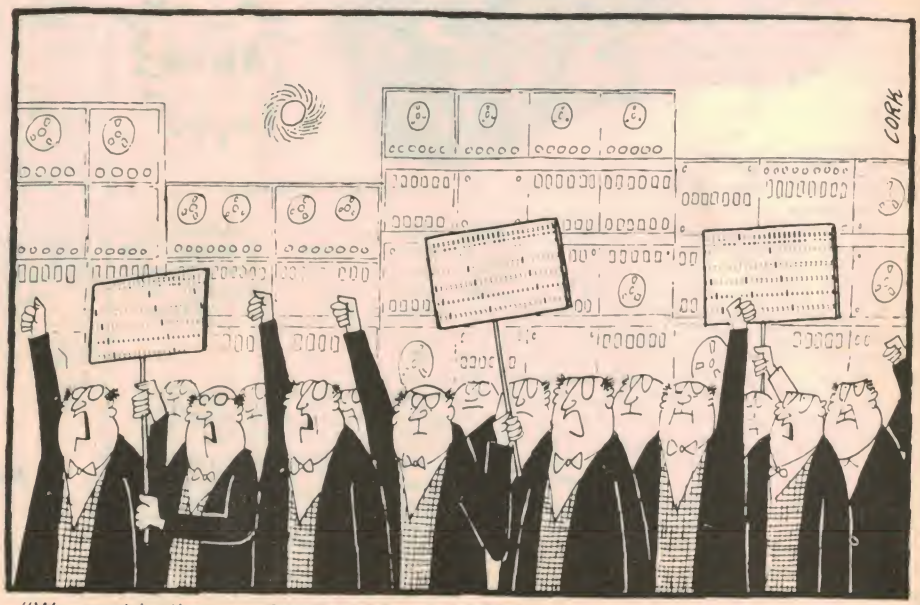
Ten years ago, personal computers, as such, did not exist and our then editor, Jamieson Rowe, was trying to satisfy his curiosity about the new world of digital electronics by lunch-time access to (as I recall) a PDP-8 professional computer owned by our parent company. If it had been a Jules Verne time machine, it could not have been held in greater awe!

At that stage, the idea of an individual owning a computer of any description was a "pipe dream" – and I use the phrase deliberately, not as a cliche. With prices as they were, we even used to debate the chances of ever possessing one as an editorial team; what chance our readers?

The only practical "poor man's" answer was a logic trainer of one kind or another and a number of these were developed and described in EA and other technical journals.

But, in August 1974, Jim Rowe came up with what we believed at the time to be the first-ever microcomputer for home construction, intended primarily to serve in an educational role. In fact, because it used an eight-bit word format, Jim had the bright idea of calling it the "EDUC-8" pronounced "Educate". Unfortunately, not every one caught on and we were frequently asked for back issues describing the "E-duck-eight"!

It transpired that, quite unknown to us, the American magazine "Radio-Electronics" had been preparing a constructional article around a microcomputer using the Intel 8008 chip. This was published about the same time and with the same objective in view: an affordable unit for tuition and self-education, and a huge forward step from a logic trainer.



"We want justice . . . 01001100 11100001"

About three years later, in March 1977, Jim Rowe came out with another personal computer using the Signetics 2650 chip, distributed in Australia by Philips. It created a lot of interest among computer hobbyists – and I stress this word – so much so that EA staff member David Edwards was inspired to produce another 2650 "Mini" computer system in May 1978.

That's all history now but, on receipt of M.L.'s letter, I rang Jim Rowe and put to him the question:

"Why the special interest, in those days, in the 2650?'

His answer was quite unequivocal:

"Because the 2650 seemed to lend itself particularly well to a hobby computer of the type readers were looking for."

Was the 2650 originally designed for use in an intelligent terminal?"

"Yes, but so were a number of other chips in those days, many of which ended up in limbo. It just so happened that the 2650 had the potential to become the heart of a quite powerful little micro. (Anyway, the Z-80 is the progeny of a long line of intelligent aunts)."

"Is it true that the 2650 was in glut supply at the time?"

"Quite the contrary; Philips had only a few samples in Australia and I'm pretty sure that they didn't realise that they had such a potentially interesting device in their catalogue. I had to lean on them to get them to bring in sufficient stocks to support the project."

WHAT WE SAID:

These statements are confirmed by the article in the March 1977 issue, which refers to the 2650 and 2608 ROM having been in short supply, with the 2650 representing a particular problem. It went on: "Happily this situation has now changed for the better. Just a few weeks ago, we learned from Philips Industries that the 2650 and 2608 chips were now readily available and at low cost."

Unfortunately for M.L., none of this accords with his story about the 2650 having been misapplied and used only because "many firms had overstocked the item". Further, that we might have been "paid to shift dead stock".

You know, I've seen people get upset about allegations less serious than that!

Looking back over the files for the same period, I was reminded of the "Mini Scamp" microcomputer, presented in the April 1977 and subsequent issues by Dr John Kennewell, of the Physics Department of Newcastle University (NSW). Using the National Semiconductor 1SP.8A/5000 SC/MP microprocessor chip, it was summarised as "the ideal way of getting into the exciting world of microcomputers at low cost".

Again, in a series beginning April 1979, we described the "DREAM" computer, using the 6800 chip and designed by Michael Bauer of the Division of Computing Mathematics at Deakin University. It was described as having been "designed especially for beginners" with a strong emphasis on tuition and self-education.

Indeed, this theme motivated and dominated all the early approaches to home-built computers: to acquire one at an affordable price, to discover what computing was all about and to gain hands-on experience. To acquire a computer was an end in itself.

DIFFERENT SITUATION

Since then, however, personal computers have become progressively more accessable, in homes, clubs, schools and even in computer shops outside of school hours. With the greater familiarity has come the consciousness that, beyond the learning stage, personal computers can fill a useful role. As I implied, right at the outset, the role may not be well understood but the expectation is there.

It would seem that this is at the root of M.L.'s disappointment. He has become involved in a 2650-based computer, has learned something of the technology and now wants to put it to everyday practical use. As a source of software programs, he had high hopes of a users group. But, alas: according to M.L.: *"The 2650 users group has folded after one issue of their bulletin."*

I can understand M.L.'s disappointment but the 2650 simply didn't belong to the era of plentiful wide-ranging commercial software. It was certainly not promoted to hobbyists on that basis and I fail to see how any charge of business morality could be justified.

When questioned further on the matter, Jim Rowe put it this way:

"In its day, the 2650 was a good chip, and one that even had certain advantages. But, when Tandy and other companies opted for the Z-80 and other such chips, the 2650 fell behind.

"It's rather like the tape recorder situation. One might own an open-reel deck that's fine for making your own recordings; but try to buy pre-recorded open-reel tapes, these days!

"The market emphasis has swung to cassettes."

And that brings us to the present crop of personal computers, including the "Super-80", based on a Dick Smith kit.

M.L. has this to say:

"I wonder if the Super-80 is even partially compatible with the 8080 or other System 80 sets? You have often written

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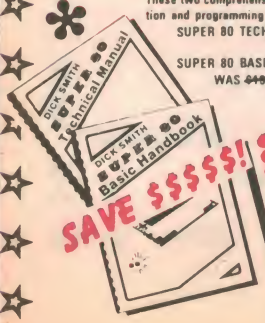

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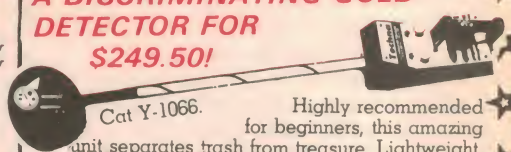

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DSE/A354/PAI

about the incompatibility of VTRs; the computer business is in a worse shambles.

"Do something at least to write some translator Esperanto so that BASIC programs can be universally used."

Yes, we have deplored the incompatibility of VTRs. In fact, over the years we have deplored many things: the incompatibility of early 78rpm records, of 33 and 45rpm records, of quadraphonic systems, of TV standards and channels, of hifi rating systems, of audio tape specifications, and so on.

It would have been logical and convenient (superficially, anyway) if everything had been tidy and uniform in those areas, and I guess the same remark could apply to computers and programs.

But, behind a great many of the glaring inconsistencies which have plagued and characterised the electronics industry is the matter of patents and it is certainly true of the computer field — from personal to large business mainframes — in the guise of copyright.

In short, lack of compatibility in programs and software is not peculiar to a few home-built designs. It occurs industry wide and at all levels.

What M.L. presumably does not realise is that companies are not free to duplicate one another's programs, interpreters or compilers under pain of infringement of copyright. They either have to enter into an appropriate royalty arrangement or create variants of their own which may then become a candidate for copyright.

And there are also practical considerations, of which an elementary example occurred in Tandy's Level I and Level II computers. To make best use of the facilities in each, there were deliberate differences in the BASIC programming.

Again, there are evident differences in the approach to copyright in two computers distributed by DSE. In the System 80, the designers chose to pay (and pass on) copyright charges giving them access to Tandy/Microsoft interpreter and thereby to Tandy software. Yet the designer of the Super 80 decided to do otherwise.

All these were commercial decisions with which individuals may agree or disagree, but the charge of "immorality" is somewhat misplaced.

As for M.L.'s remark about some computer "Esperanto" to help bridge the gap between software programs, we have seen at least one recent example of such technology. The big question-mark hanging over it is the possibility of it breaching copyright.

"Immorality" of the reverse kind!

So, like it or not, we face the situation where individual computers have their own specifications, their own capabilities, their own limitations and, of course, their own price level. They are offered without software, with a certain range of software, or claimed compatibility with software from other sources.

The wise purchaser will not just go out and buy a thing called a computer — any more than he would go out and buy a thing called a motor car.

The wise purchaser will give some thought to its role beyond the "I'd like one" stage.

Is it likely to be most used for mathematics or a teaching aid? For home management or small business? For indexing or filing? As a typing aid or word processor? For graphics where colour may be vital? Or mainly for games?

If M.L. can be upset because his humble 2650 kit computer no longer lives up to his expectations, how will you feel if a much more costly acquisition turns out to be a digital white elephant — because you didn't think far enough ahead?

Another problem: He can't read Japanese!

J.C. of Macquarie, ACT, is a very unhappy computer buyer, for reasons quite different from those of M. L. He is quite sure, he says, that most of us have had a good natured giggle, at the quaint Japanese-English that one encounters in the owner's manual for an inexpensive Japanese product.

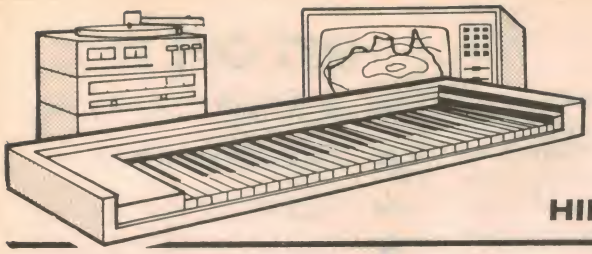
But it is not easy to be amused when the product is a computer plus peripherals, running well into four figures.

The Japanese manuals appear to be well prepared, says J. C., but the English language manuals (?) are poorly presented, full of "ambiguities and incomprehensions" and incomplete.

"One knows that there exist such functions as Insert, Kill, List, Print, &c but must guess as to how they may be implemented; and there are a dozen or more error codes but absolutely no clue as to what they mean."

J.C. concludes: "I was all prepared to start hunting for a Japanese speaking person to help me translate, but why should I have to? I paid for documentation in the purchase price.

It's a pity because, otherwise, it's a damn good machine."



Audio-video Electronics

HIFI • HOME VIDEO • PROFESSIONAL AUDIO

A chicken-or-egg dilemma for Cherry Pie!

In case you should conclude that the writer of the above headline has at last gone around the bend, I hasten to confirm that the producers of Cherry Pie audiophile records are indeed facing a chicken-or-egg situation: should they take full advantage of modern recording technology now, or wait for playback equipment to catch up?

by NEVILLE WILLIAMS

The basic problem is not a new one. Arguments about the relative merits of recording and playback equipment have been in progress for almost as long as there have been modulated grooves on cylinders and discs.

What makes it newsworthy right now is that it's affecting audiophile recordists and audiophile listeners – you and you and you – and it's doing so right here in Australia.

In fact, it was brought to my attention by a phone call from Graeme Rule, Managing Director of Cherry Pie Records in Sydney, who said his piece, and ended up with the question: "How do you read the situation?"

I could offer no new or instant answers, but I could undertake to talk about it in print, and this is what I am doing.

As I remarked a few lines back, the basic problem has been with us from the earliest days of recording. For as long as I can remember, there have been arguments about whether particular records are really "unplayable", or whether they only appear to be, because available pickups aren't equal to the task.

Recording engineers, with their exotic lathes, amplifiers and cutting heads, have always liked to believe that they've held the technological initiative, and that they still hold it. Perhaps we should ask a company like Ortofon, who have a foot in both camps!

But, to start from scratch (no pun intended) the original groove is inscribed in the surface of a cylinder or disc by a cutting stylus which is subjected to a considerable amount of audio drive power. (This is particularly true of the electrical recording systems which were widely adopted in the late '20s).

With sufficient audio power applied, the tip of a recording stylus can be made to vibrate very freely in vertical, lateral or oblique mode, depending on the recording format. In so doing, it cuts a groove which contains a complex pattern of cyclic waveforms, serrations, kinks and corners. At least, that's what they look like under a microscope!

When copies of a recording reach the consumer, the groove has to be traced by a playback stylus – cyclic waveforms, serrations, kinks and corners alike – in order to recover the original audio signal. And here a problem arises.

MECHANICAL PROPERTIES

Even though a playback system may employ electrical amplification, the stylus itself, tracing a groove, is still a mechanical device involving a certain tracking weight, moving mass, compliance, stiffness, resonance and so on. More than that, additional mechanical qualities are introduced by the supporting arm and headshell, the turntable and even by the disc itself.

The combination of such characteristics determines whether the playback stylus can, in fact, trace a given groove, accurately or at all! The cyclic waveforms maybe have too great an amplitude, the serrations may be too fine, the kinks too devious and the corners too abrupt!

The Sydney Wind Quintet: Michael Scott — flute; Josef Hanic — oboe; Gabor Reeves — clarinet; Gordon Skinner — bassoon; Anthony Buddle — horn.

For sure, the recording industry follows certain frequency and amplitude conventions to help matters along (the RIAA standards) but the above remark still stands.

Minor mistracking can result in reduced treble response and/or a certain harshness in high frequency musical tones. More serious mistracking, with the stylus "rattling" in the groove will produce obvious distortion – plus record wear. In an extreme case, a stylus may simply jump tracks or, worse still, carve its way through a groove wall.

EARLY PROBLEMS

In the later '20s and early '30s, considerable argument followed the adoption of electrical recording methods. It became possible for engineers, not only to extend frequency response, but to record at a higher level, in the interests of signal/noise ratio. They had to restrain their enthusiasm, however, in the knowledge that many record buyers were still using mechanical phonographs with massive acoustic tonearms and an extremely stiff stylus mechanism.

In fact, the shadow of the acoustic phonograph remained on the disc record industry right through until after World War II. Phono pickups were lighter and stylus mechanisms more compliant than their acoustic counterparts, but that was scarcely much of a recommendation. They still used steel needles or other removable stylii, screw chucks and suspension systems that were stiff and heavy.

Towards the end of the era, companies like Decca in the UK (with ffrr) and, on a limited scale, AWA (Radiola) in Australia, tried to break through the traditional constraints with 78 rpm discs using finer grooves, improved specifications and a better moulding formulation. But they had to let it be known that such discs were really only suitable for use with what then passed for audiophile pickups.

After that, of course, we went through the exquisite agonies attending the birth of the LP disc, followed shortly afterwards by LP stereo. One could write a whole book about lower mass steel needles, magnetic chucks and jewel styli, including "cranked" designs intended to add a bit of compliance of their own.

And I guess, too, that a book could be written about the efforts of companies like Acos/Cosmocord to create a true audiophile version of the ubiquitous crystal/ceramic cartridge.

At about the same time Goldring (UK) were trying to re-exploit the magnetic principle, with innovative – if not always successful – ideas.

And, for good measure, every now and again, another company would come up with yet another idea: highly exotic, loudly proclaimed, then forgotten!

At right: the Funai video system. Below: the Eiki Analyser projector.

HANIMEX A-V ON SHOW

At a recent presentation in the Sydney Opera House complex, the audio visual Division of Hanimex displayed some of the products currently available.

Prominently on display was the portable video system (pictured above) manufactured in Japan by Funai but carrying the Hanimex logo for Australia. Claimed to be the lightest portable video system currently available, it uses a video cassette similar in size to an audio cassette.

For those requiring more conventional portable video equipment, Hanimex offer a VHS format system produced by a major Japanese manufacturer.

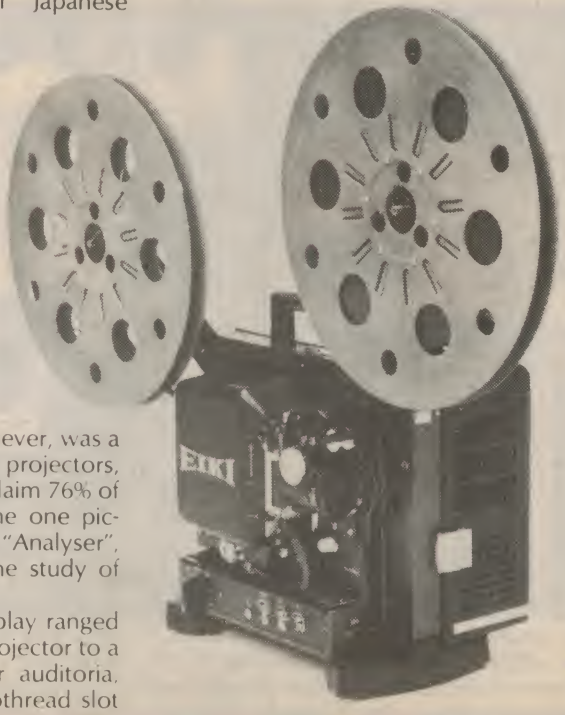
For further details of these items, or for a copy of the Hanimex Audio Visual Products catalog, contact Bert Heyman, Manager A-V Division, Hanimex Pty Ltd, 108 Old Pittwater Rd, Brookvale, NSW 2100. (02) 938 0230.

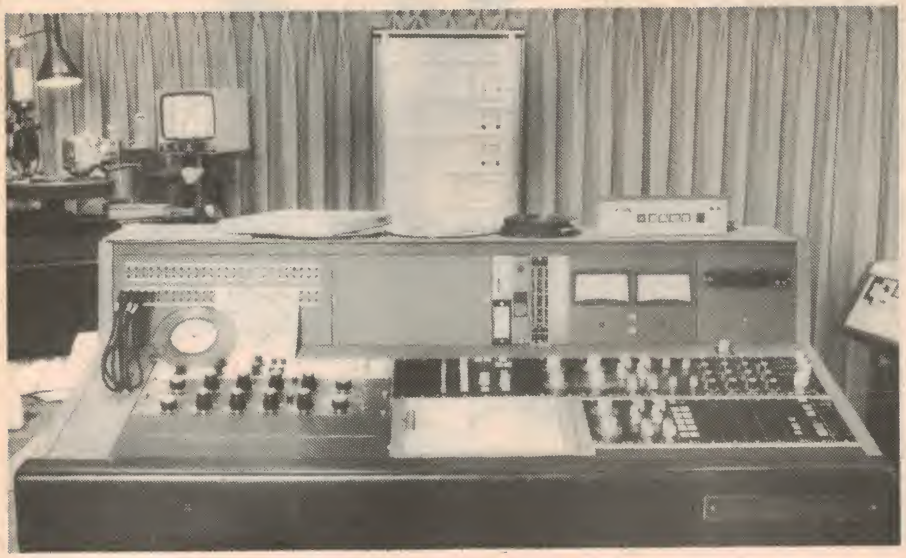
Dwarfing the video, however, was a display of Eiki 16mm film projectors, which Hanimex say now claim 76% of the Australian market. The one pictured at the right is the Eiki "Analyser", especially intended for the study of sportsaction, etc.

But the Eiki units on display ranged from a normal portable projector to a large pedestal model for auditoria, with others featuring autothread slot loading, infrared control and automatic repeat.

An interesting demonstration was given of the "Soundpacer" cassette deck which can replay speech tapes at up to twice normal speed, while preserving the natural pitch of the voice.

Other items included slide projectors, overhead projectors and accessories, a combined cassette player and PA amplifier, and induction loop headsets, cameras, calculators, a Teletext adaptor and a variety of other items.



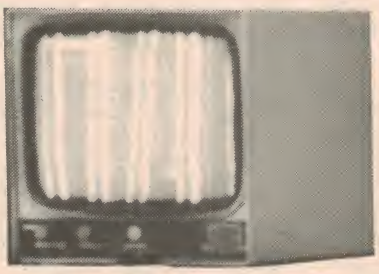


The console in Festival's recording centre provides all the necessary facilities for patching, equalising and monitoring the signals fed to the recording lathe (rear left). The rack behind the console contains the power amplifiers for driving the cutter and monitor loudspeakers, plus other ancillary equipment.

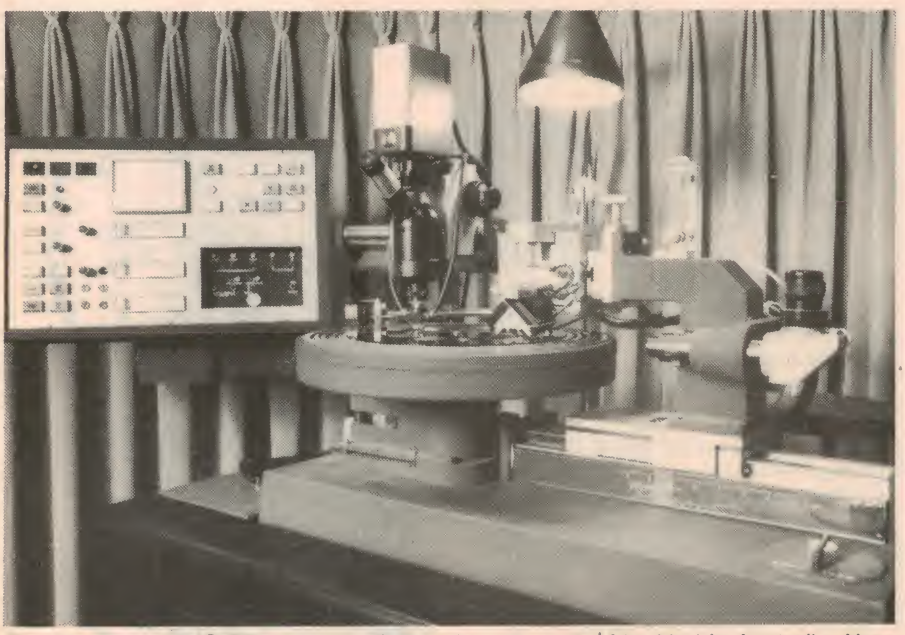
Why? Because dedicated audiophiles – many of them executives of these same companies – were seeking to recover from the record grooves every last vestige of signal information which recording engineers had managed to impart to them.

Yes, it's been a long, dogged quest, with the end of the playback rainbow always just a bit further down the track.

And now we've arrived at the borders of Digital Land, where everything promises to be different. But notwithstanding that, we're still questing; still arguing about traditional methods. How much further can we refine the principle of recovering a signal with a tiny coil or a tiny magnet attached to a diamond stylus?



A close-up of the monitor screen (top left) displaying grooves as seen through the optical microscope.



The Neumann VMS-80 recording lathe, the only one of its kind in Australia. Note the optical microscope and the macro TV camera which displays the grooves on a TV monitor screen, normally accommodated on the pedestal at right. The panel (left) is the logic control system for the automatic groove spacing.

The latest burst of activity followed the emergence of digital tape master recordings. Phono cartridge designers suddenly found themselves with some more catching up to do.

While ever engineers had to make their master recordings on analog tape decks, they had to be content with a dynamic range of around 70dB, if the signal level was to remain in the dynamic "window" set by background noise at one extreme and by overload at the other. But, after mix-down and processing, the dynamic range from a typical disc was more likely to end up around 60dB.

Recording engineers were well aware of the limitations of analog tape mastering and a few hardy souls reverted to direct-to-disc recording. It sounded fine but the practical difficulties were well nigh prohibitive.

DIGITAL MASTERING

Digital tape mastering proved to be a very attractive alternative, because it offered the convenience of a tape master, together with a high degree of signal "transparency" – zero wow and flutter, low noise, low distortion and a dynamic range of around 90dB.

Once on digital master tape, the performance can be re-played and examined as many times as necessary. It can be pre-set precisely to the anticipated dynamic window of the disc and fed to a lathe with computer-controlled variable groove pitch. For good measure, the groove can be – and commonly is – cut at half-speed, for improved high frequency definition.

(For sure, some audiophiles have reservations about digital mastering for other reasons, but that is another subject. In any case, an engineer who so prefers can record on analog, using dbx compression/expansion and end up with much the same dynamic range.)

The American Telarc organisation was one of the first to exploit high dynamic range in disc recordings. They have since turned out a whole string of advanced technology albums, usually recorded, in the first instance, on a Soundstream digital master tape deck.

The transfer to disc has normally been done by the JVC Cutting Centre, using state of the art equipment, and with both tape and disc operating at half normal speed. The final pressings of these and other audiophile discs are normally done with top quality virgin vinyl by – or supplied by – Teldec of Germany.

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notorious — of the albums was a recording by the Cincinnati Orchestra, with Erich Kunzel conducting, of Tchaikovsky's "1812 Overture". The bells were recorded separately at a Memorial Carillon in Ohio, while the cannons were 19th century pieces by an antique arms group — the Fifth Virginia Regiment. Mixed into the final track, they provided a series of 16 thundering reports with an ignition crack at around 2000-3000Hz and a follow-up boom which reaches down to around 6Hz.

WORDS OF WARNING

When Telarc first issued the recording, they saw it as something of a milestone in disc technology. An outer wrapper on the jacket carried the message:

"Audio's toughest challenge: This special version of the 1812 Overture demonstrates the incredible dynamic range that can actually be transcribed to disc from the original digital master recording."

An inner leaflet warns that the disc "tests the limits of playback technology".

It warns the newcomer to be cautious in the first playing "until a safe playback level can be established".

It stresses the need to have the pickup correctly adjusted but indicates that, even so, "particular cartridges or cartridge/tonearm combinations may mistrack".

Whatever other rewards Telarc may have received from the 1812 Overture, they certainly got plenty of publicity. The album became famous (or notorious) with audiophiles, worldwide. It prompted articles, macrophotographs and endless discussions about trackability.

It also helped fuel a spirited argument as to whether wide dynamic range is desirable or manageable in a home listening situation.

That's all history now, but the Cherry Pie situation belongs to the present.

Cherry Pie is a small Australian record company which has traditionally placed what emphasis it could on recording quality. They have tended to concentrate on musically sophisticated jazz and folk artists and small classically orientated groups.

In recent times, they have built up a close working relationship with the engineers of Festival Records in Sydney, attracted by the equipment which that company now has available.

The association was climaxed, recently, by the opportunity for Cherry Pie to record a recital by the Sydney Wind Quintet — the Quintet-in-Residence at the NSW State Conservatorium of Music. Each player is the Lecturer in his respective instrument and each one is a concert and solo artist in his own right. Since coming together in August 1980, the Quintet has arranged extensive engagements with the ABC, plus tour commitments interstate and overseas.

The original recording was made on a Sony model 1610 digital recorder and proved to be of such a quality that Cherry Pie decided that it warranted world release, in full competition with audiophile recordings from any country.

They had at their disposal the Sony 1610, Sony digital editing equipment, a Neumann VMS-80 recording lathe (the only one of its kind in Australia), a Neumann SK-74 cutter and a FAL-7 rack. Quality presses were available, operating at reduced speed under manual control, plus virgin vinyl produced by an associated company.

The recording was duly transferred to a master disc and a few trial pressings were run. They sounded good on Festival's own playback equipment, so about half-a-dozen of the test pressings were passed by Graeme Rule to personal friends who he knew to have prestige hifi equipment.

But the reports were't quite what he expected. Most said "fine" but two insisted that the discs were badly distorted on loud passages.

Back at Festival, the same two discs played perfectly.

Further investigation revealed the disturbing fact that the two audiophiles who had complained were using moving coil cartridges — different brands, but favoured because they were reputed to be "more musical" than moving magnet types.

A TRACKING PROBLEM

When it became apparent that they faced a tracking problem, the owners tried again, with increased playing weight. One cartridge did manage to cope, with the tracking weight at the manufacturer's maximum recommended figure; the other still couldn't track the loud passages, extra weight notwithstanding. It was at this stage that Graeme Rule rang me, as noted at the start of the article. Should they market the record in its present form, or re-cut at a lower amplitude? And what was my attitude to moving coil cartridges?

The claims about the "musicality" of moving coil cartridges go back at least as far as the original Ortofon moving coil designs, with our former Editor, the late John Moyle, one of their keen protagonists. "Listen to those strings", he would say.

The problem is that, historically and on a per-dollar basis, moving coil cartridges have often not shown up as well, on measurement, as their moving magnet counterparts in terms of compliance and

A COMPACT MUSIC SYSTEM FROM SANYO

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effective stylus mass. These are the very qualities that determine trackability and the need to resort to extra tracking weight.

And that leads naturally to speculation (and argument) as to whether the somewhat elusive "musicality" is worth having if the price is reduced ability to cope with high amplitude deviations? In short, is musicality worth having, if you can only have it at moderate levels?

It was against this background that I took delivery of a couple of test pressings of the Sydney Wind Quintet recital. Anticipating the material, and on inspection of the grooves, it was immediately obvious that there was no massive bass content, resembling that in the "1812 Overture". If the grooves did pose tracking problems, they had to be in the middle and upper register (involving effective stylus mass) rather than low down (involving low frequency compliance).

Largely because the phono deck was set up that way, my first playing of the test pressing was with the Ortofon Concorde STD, a moving magnet cartridge. There was no hint of mistracking and, without all the prior discussion, I would not have expected any.

So to a moving coil cartridge – the Ortofon MC-20 Mk II. It sounded very clean and very comfortable, completely in line with our review of the cartridge in September '81.

Following that, we checked all the heavy passages with two other moving magnet cartridges on hand – a Goldring G-900 IGC, and a Shure V-15 Mk III with a stylus which has played a lot of records. Again, there were no problems.

Finally, we got out a venerable Shure M-55 and played the disc right through. It sounded its age, but it didn't mistrack. And that had to be a complete anti-climax. Why had two out of six audiophiles encountered tracking problems with a pressing that proved to be not all that fearsome?

For sure, we are talking about a tiny sample, with the possibility of faulty cartridges. Even so, the exercise did point up a couple of inhabitants of Audiophile Land happily using "musical" cartridges which couldn't cope with an audiophile recording! Presumably they, and others like them, will have been bitterly disappointed at the "distortion" which they think they have heard in some modern pressings.

While I certainly don't regard recordings as being uniformly beyond reproach, I do wonder how many may have been damned because of tracking problems in cartridges and peak signal overloads in preamplifiers.

As it is, Graeme Rule tells me that his company has decided to release the Sydney Wind Quintet recording in its present form but with the endorsement that it can be expected to play satisfactorily only with cartridges having high compliance and low tip mass.

Audiophile pressings are scheduled for release through Festival in mid-October and should be available in all shops which carry classical records.

They'd better be good – otherwise everyone concerned will have a cherry red face!

FOOTNOTE: Just as I was rounding off this article, I had a phone call from a dealer who handles a lot of audiophile records. "Tell me," I said, do you hear of many problems with phono cartridge trackability?"

"Fortunately, not many," he replied, "but I will say this – and please don't quote me by name – there are two or three quite expensive moving coil cartridges around that have real problems in this area!"

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NUMBER 1 COMPONENTS

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JAYCAR PASSIVE COMPONENTS

We regret to advise that we have had to pass on drastically increased costs due to the devaluation of the Australian dollar and the savage sales tax increase.
Most of the prices on this page had not changed in 18 months. In some cases our cost has increased 50% whereas our increases average about 10%. We haven't got the heart to pass on to you the costs that were passed on to us!
We are very proud of our range of components at Jaycar. Our quality is first class — so remember that if someone offers you a component that may APPEAR cheaper.
Jaycar components are 100% prime spec and guaranteed. They are the same parts that were used in TV stations, telephone exchanges and other industrial equipment.
NOTE! We have saved space in some places by saying that components conform to "E12". This means that we have 12 values in each "decade" i.e. 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and back to 10 in other words, 22pF, 220pF, 2200pF and so on.

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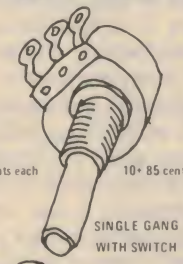
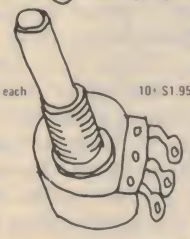
Price 1 – 9 95 cents each			10+ 85 cents each



LINEAR			LOG
			1k
		SINGLE GANG	5k
		WITH SWITCH	10k
25k			25k
			50k
			100k
			500k
1M			1M
			2M
Price 1 – 9 $2.25 each			10+ $1.95 each



DUAL GANG LINEAR	LOG
5k	5k
10k	10k
25k	25k
50k	50k
100k	100k
500k	500k
1M	1M
Price 1 – 9 $2.25 each	10+ $1.95 each

Dual gang with switch 100k log (only) $3.95 each

CARBON SLIDER CONTROLS
45mm type — some with tap

LINEAR	LOG
2k	1k
10k	5k
50k	50k
100k	250k
Price 1 – 9 $2.95 each	10+ $2.50 each

30mm type 5k linear only $1.95 each
60mm type 10k lug only $3.95 each

WIREWOUND POTS
3 watt rating (linear). ¼" shaft, 3/8th bush.
10 ohms, 25 ohms, 50 ohms, 100 ohms, 500 ohms, 1k, 5k
Price 1 – 9 $3.45 each 10+ $2.95 each

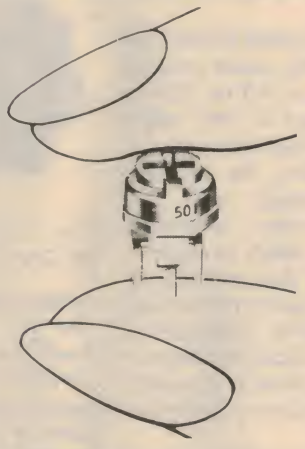
Jaycar stocks two types of trimmers. The low cost "skeleton" type and the high quality "PIHER" European made dust proof type

MINIATURE VERTICAL (SKELETON)
100 ohms, 250 ohms, 500 ohms, 1k, 2k, 5k, 10k, 25k, 50k, 100k, 250k, 500k
Price 1 – 9 42 cents each 10+ 40 cents each

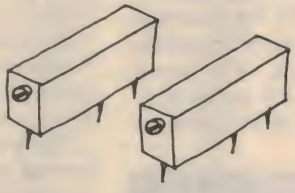
LARGE VERTICAL (PIHER TYPE)
100 ohms, 200 ohms, 500 ohms, 1k, 2k, 5k, 10k, 20k, 50k, 100k, 200k, 500k, 1M, 2M
Price 1 – 9 48 cents each 10+ 45 cents each

SMALL HORIZONTAL (PIHER)
100 ohms, 500 ohms, 1k, 2k, 5k, 10k, 20k, 50k, 100k
Price 1 – 9 45 cents each 10+ 42 cents each

CERMET (Ceramic/Metal Film/Oxide)
High stability trimmers in a small package. 1/3rdW dissipation, dustproof, 100ppm T.C., 5mm lead spacing (.1" grid).
100 ohms, 500 ohms, 1k, 2k, 5k, 10k, 20k, 50k, 100k
Price 1 – 9 65 cents each 10+ 60 cents each



MULTITURN TRIMMER POTS
(Sometimes called 10 turn). Jaycar multiturn trimmers feature Cermet element, leadscrew drive with over-ride clutch, sealed design and industry standard pin spacing.
100 ohms, 500 ohms, 1k, 2k, 5k, 10k, 20k, 50k, 100k, 1M
Price 1 – 9 $1.95 each 10+ $1.75 each



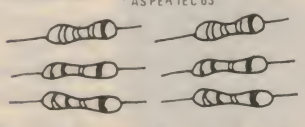
RESISTORS

RESISTORS We stock ¼ and 1 watt 5% carbon film in the E12* series. i.e. 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82. From 1 ohm to 10 Megohm

¼W 5%	1 – 9 5 cents each	10+ 4 cents each
½W 5%	1 – 9 5 cents each	10+ 4 cents each
1W 5%	1 – 9 9 cents each	10+ 6 cents each

These are QUALITY OEM grade carbon film resistors — NOT junk
METAL FILM We only stock ¼W but in the extended resistance range E24*. i.e. 24 resistance values per decade. 1, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91
Resistors between 10 ohms and 1 Megohm have a temperature co-efficient of 50ppm 1% tolerance and conform to Mil-R 10509F RN600 style
Values below 10 ohms and above 1 Megohm are Beyschlag 2" types.
Prices Below 10 ohms and above 1M 1–9 25 cents each 10+ 20 cents each

* AS PER IEC 63



CAPACITORS

TANTALUM BEADS also called 'TAG' tantalums.
This is a brand name that has become a description.

VALUE	VOLTS	1 – 9	10+
0.1uF	35	55	50
0.22uF	35	60	55
0.33uF	35	60	55
0.47uF	35	60	55
1uF	35	60	55
1.5uF	35	60	55
2.2uF	35	60	55
3.3uF	35	60	55
4.7uF	35	60	55
6.8uF	35	60	55
10uF	25/35	65	60
22uF	25	65	60
33uF	16	70	65
47uF	10	70	65
100uF	3	70	65

RBLL CAPACITORS
Logical and economical replacements for Tantalums
0.1uF, 0.15uF, 0.22uF, 0.33uF, 0.47uF, 0.68uF
Price 1 – 9 32 cents each 10+ 30 cents each
1uF, 1.5uF, 2.2uF, 3.3uF
Price 1 – 9 35 cents each 10+ 32 cents each
4.7uF – 38 cents each 1 – 9 10+ 35 cents each
6.8uF – 40 cents each 1 – 9 10+ 36 cents each
10uF, 22uF, 33uF
Price 1 – 9 45 cents each 10+ 42 cents each
47uF – 50 cents each 1 – 9 10+ 45 cents each
100uF – 60 cents each 1 – 9 10+ 52 cents each

TRIMMER CAPACITORS
Features *Fully sealed * Top adjustable * Solid dielectric * 5mm lead spacing * Colour denotes capacitance range * Temperature co-efficient N750 ppm/degree C (average) * Q (1MHz C. max) 500.
2.0 – 7pF BLUE
5.2 – 30pF GREEN
6.8 – 45pF YELLOW
9.8 – 60pF BROWN
Price 1 – 9 65 cents each 10+ 60 cents each

POLYSTYRENE Jaycar Polystyrene dielectric capacitors are used where stability is important. They exhibit low dielectric leakage as well
Range 33pF thru 1000pF (IEC E12 Series)
most are 100V rated
Price 1 – 9 30 cents each 10+ 28 cents

CERAMIC Jaycar capacitors are generally NPO, 50V plate 10% types
Range 1pF – 1000pF (IEC E12 Series)
and — 2200pF, 3300pF, 0.0047uF, 0.0056uF, 0.0068uF, 0.0082uF, 0.01uF, 0.022uF, 0.033uF, 0.047uF, 0.1uF, 0.22uF, 0.33uF, 0.47uF
Price 1 – 9 15 cents each 10+ 12 cents each
100pF 3kV 50 cents each
CERAMIC TRIMMER
1 – 12pF 25 cents each
4 – 20pF 25 cents each

BIPOLAR ELECTROLYTICS Quality made by ELNA
RB type

		1 – 9	10+
2.2uF	25V	55	50
4.7uF	50V	60	55
6.8uF	50V	60	55
10uF	50V	60	55
22uF	50V	65	60
47uF	50V	80	72

ALUMINIUM ELECTROLYTICS
Both axial (RT) and single ended radial (RB) types kept. We keep a large range of the now popular RB types. Each capacitor is fitted with a durable vinyl jacket which has the value and polarity clearly marked

AXIAL TYPES

Capacitance	Voltage	1 – 9	10+
1uF	50	28	26
3.3uF	25	28	26
4.7uF	25	28	26
4.7uF	63	32	30
10uF	16	28	26
10uF	63	34	32
25uF	25	28	26
25uF	63	36	34
47uF	10	28	26
47uF	63	36	34
100uF	10	36	34
100uF	25	38	36
100uF	63	40	38
100uF	350	$3.50	$3.00
470uF	10	80	75
470uF	50	$1.20	$1.10
1000uF	10	$1.10	$1.00
1000uF	63	$1.80	$1.70
2500uF	16	$1.25	$1.15
2500uF	35	$1.95	$1.85
2500uF	60	$2.45	$2.35
3300uF	16	$1.95	$1.80
4700uF	35	$2.95	$2.60

RADIAL (RB) TYPE

0.47uF	63	28	26
1uF	50	28	26
2.2uF	50	28	26
4.7uF	25	28	26
4.7uF	50	36	34
10uF	25	28	26
22uF	50	36	34
25uF	25	28	26
33uF	25	30	28
47uF	16	28	26
47uF	25	30	28
47uF	50	36	34
100uF	16	30	28
100uF	25	32	30
100uF	63	50	46
220uF	25	55	50
220uF	35	75	70
220uF	50	85	80
330uF	25	78	72
470uF	35	78	72
470uF	63	$1.30	$1.25
1000uF	16	55	52
1000uF	25	82	78
2500uF	35	$1.45	$1.40
2500uF	80	$5.45	$5.20
4000uF	75	$7.50	$6.95
5600uF	40	$4.95	$4.45
8000uF	75	$9.95	$9.25
10000uF	40	$7.25	$6.85

GREENCAPS or more precisely Metallised Polyester
Our Greencaps (many of which are BLUE!!) are prime spec OEM quality — not necessarily the cheapest we can buy!
Jaycar Metallised Polyester (sometimes also called 'Mylar') caps exhibit high 'Q' and low inductance and generally have 100 – 125V working
Values 1nF thru 47nF (0.001uF – 0.47uF)
in IEC E12 Series as well as the following values
10nF, 22nF and 33nF
Price 1nF (0.001uF) thru 22nF (0.022uF)
1 – 9 22 cents each 10+ 20 cents each
27nF (0.027uF) thru 56nF (0.056uF)
1 – 9 24 cents each 10+ 22 cents each
68nF (0.068uF) thru 220nF (0.22uF)
1 – 9 32 cents each 10+ 30 cents each
270nF (0.27uF) 40 cents each 1 – 9 10+ 35 cents each
330nF (0.33uF) 40 cents each 1 – 9 10+ 35 cents each
390nF (0.39uF) 45 cents each 1 – 9 10+ 40 cents each
470nF (0.47uF) 60 cents each 1 – 9 10+ 55 cents each
1000nF (1.0uF) $1.45 each 1 – 9 10+ $1.35 each
2200nF (2.2uF) $1.45 each 1 – 9 10+ $1.35 each
3300nF (3.3uF) $2.45 each 1 – 9 10+ $2.25 each

630V GREENCAPS High Quality
Relatively small in size

	1 – 9	10+
10nF (0.01uF)	32	30
22nF (0.022uF)	38	35
33nF (0.033uF)	42	40
47nF (0.047uF)	49	46
100nF (0.1uF)	60	56
220nF (0.22uF)	88	84
330nF (0.33uF)	$1.10	$1.05
470nF (0.47uF)	$1.30	$1.20

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Shure V-15 Type V phono cartridge

The V-15 Type V, successor to the V-15 Type IV, has just been released by Shure as their top-of-the-line cartridge. By using a beryllium cantilever, Shure claims 80cm/sec tracking ability at 5kHz. Other features include a free test record and alignment gauges.

Shure Brothers have created quite a reputation in the hi-fi field with their range of phono cartridges. Top of the range has been the V-15 series of cartridges the last of which was the Type IV, released in 1978. This incorporated the Shure dynamic stabiliser, a damped carbon fibre brush that reduced the effect of tone arm resonances and also allowed the cartridge to track accurately over record warps.

Now, after a gap of four years, Shure has released another model in the V-15 range, the Type V. Resemblances to the Type IV can be seen in the continuing use of the dynamic stabiliser and the retention of the Type IV's tip geometry.

The V-15 Type V is a moving magnet design, like all Shure cartridges, and uses a "Hyperelliptical" nude diamond tip. This is a broad contact tip, similar in principle to the Shibata CD4 tip, and is used because it results in lower tracing distortion compared with conventional spherical and biradial tips. By using a thin-wall beryllium shank, and a smaller diamond tip, Shure have decreased the effective moving mass of the Type V's stylus assembly by 40% compared to the Type IV.

This gives a two-fold benefit. Firstly, the stylus tip resonance has been moved from 21kHz (in the Type IV) to 33kHz, giving a flatter response in the audio band. Secondly, with less mass to accelerate and decelerate, the tip can maintain intimate contact with the groove at higher recorded velocities. Therefore the tracking ability is improved with Shure claiming that the Type V will track an 80cm/sec signal at 5kHz and a 60cm/sec signal at 10kHz. These are extremely high figures, indicating that the V-15 Type V should be able to accurately track any signal found on a commercially available record.

Another feature of the cartridge is the Side Guard stylus protection system which protects the stylus against side thrust. These can occur if the tonearm is bumped while playing a record or if the stylus contacts the edge of the record or turntable platter. The protection system operates by withdrawing the entire stylus tip and shank into the stylus housing upon application of a sideward force.

This audio test record is included in the purchase price of the V-15 Type 5 and allows the system to be adjusted for optimum performance.

The V-15 Type V – Shure's latest top-of-the-line cartridge.

Also included in the purchase price of the V-15 Type V is the Shure TTR117 Trackability Test Record. The seven tests on this record allow the system to be adjusted to its optimum point and then the level at which mistracking occurs to be found. This level gives a trackability factor for the cartridge which is combined with the indentation factor for the tip (listed on the record jacket) to produce a new performance parameter called the "Total Trackability Index" (TTI).

Shure defines TTI as: TTI = Trackability Factor x Indentation Factor and provides notes on the record jacket covering the theory behind the TTI parameter.

The indentation factors listed on the record jacket are the results of Shure's research into the relationships between tracking force, tip geometry and record wear. A cartridge stylus indents (deforms) the record vinyl as it passes, however providing the indentation is not too deep, the vinyl will spring back and resume its original shape. If the vinyl does not spring back, the modification to the record groove will obviously cause distortion on subsequent replays.

Different tip geometries have different contact areas, so that a tracking force which causes damage with one tip will cause no damage when used with a tip of larger contact area. The depth of indentation relates directly to the rate of wear of record grooves and its reciprocal (1/indentation depth) can be considered as a measure of the relative gentleness with which the stylus treats the record.

Shure call this the "indentation factor" of the stylus tip.

The reference against which other styli tips are compared is a 15μm spherical tip. This is given an indentation factor of 1.00 at a tracking force of 1 gram. Tips with a larger contact area, eg 3.8 x 100μm, have indentation factors as high as 1.26 meaning that there is less wear on the record groove for the same stylus pressure. (Remember that the indentation factor is an inverse quantity and as such a high factor corresponds to low wear.)

Another way of looking at this indentation factor, according to Shure, is to say that 100 plays of a record on the standard spherical stylus will result in the same amount of record wear as 126 plays on the larger contact stylus with both set to the same tracking force.

Shure claims that this Total Trackability Index "is a single number that fully describes the dynamic performance of a cartridge over the entire audio range". While this description seems to be a little ambitious, it does appear that Shure has come up with a usable method for taking into account not only the tracking ability of the cartridge but also the record and tip wear caused by the tracking force and tip geometry. Cartridges that require heavier tracking forces or have inferior tip geometries are penalised by giving them a lower indentation factor which results in a lower Total Trackability Index.

The V-15 Type V we reviewed arrived in a small plastic case containing not only the cartridge, but two alignment gauges and a number of alignment aids. Printed information included a small booklet, written in promotional style, describing various features of the cartridge and two leaflets which provided instructions for removing the cartridge from its holder and installing it in the tone arm. A third leaflet is a computer printout of the results achieved by the cartridge during Shure's quality control tests. These tests include output level, channel balance, separation at 1kHz and 10kHz, phase and frequency response.

Mounting the cartridge is easy, thanks to the use of plastic "nuts" rather than the more conventional metal ones. The plastic nuts slide into keyways on the cartridge body and are held there, by the keyways, while the mounting screws are inserted and tightened.

Despite a scarcity of English on the alignment gauge instruction sheets, the diagrams are quite clear, which is a great help when using the gauges for the first time. One gauge is a flat metal plate which contains the cartridge holder, the other is a grey, dummy stylus.

The latter alignment gauge allows the user to check whether the headshell is parallel to the record surface, a necessity if the best stereo separation is to be obtained. Small adhesive shims are also provided which allow the cartridge to be tilted if the headshell is of the fixed variety and cannot be rotated.

The second alignment gauge allows the cartridge to be aligned for minimum lateral tracking distortion. This adjustment is normally achieved indirectly by adjusting the stylus overhang distance but according to Shure, theoretical analysis has shown that when the cartridge is aligned so that it is tangent to the groove at two places on the record, 66 and 120.7mm from the record centre, minimum overall distortion due to lateral tracking error is achieved. The second alignment gauge, called the Duopoint Alignment Gauge, adjusts the cartridge at these distances so that it meets the above criteria for minimum distortion.

With the cartridge mounted, we used the Shure TTR117 test record to optimise the system. The first test band on the record contains tests for identifying the left and right channels and checking the channel level and balance. The second test band contains tones for checking the phasing of the cartridge and speakers. The third test band is a skating compensation check which allows the antiskating adjustment to be optimised.

The commentary provided with the above tests is excellent, and the results of the tests are quite audible and unambiguous. An example of this is the skating test where a harsh, rasping tone suddenly appears in one channel or the other when the antiskating control is set either too high or too low.

The second side of the record contains trackability and tonearm resonance tests.

As the tracking ability of the Type V is a major selling point, Shure have gone to a lot of trouble with the trackability test. In fact more than half the second side of the record is devoted to this one test.

Firstly there is a verbal description of what to listen for. Next, there are three demonstration bands of increasing level, which have increasing amounts of distortion. Then a tone band with no distortion for use as a comparison. Finally, there is a lengthy introduction to the tests and then the tests themselves.

They comprise six bands of tones of increasing level, with tones cycling through three intensity peaks. The tones in each band consist of a mixture of three sine waves, with frequencies of 200Hz, 2.1kHz and 17kHz, mixed together in proportions similar to that found in normal program material. At the highest level, the peak recorded velocities are 3.3, 21.0 and 20.0cm/sec respectively, for the three frequencies.

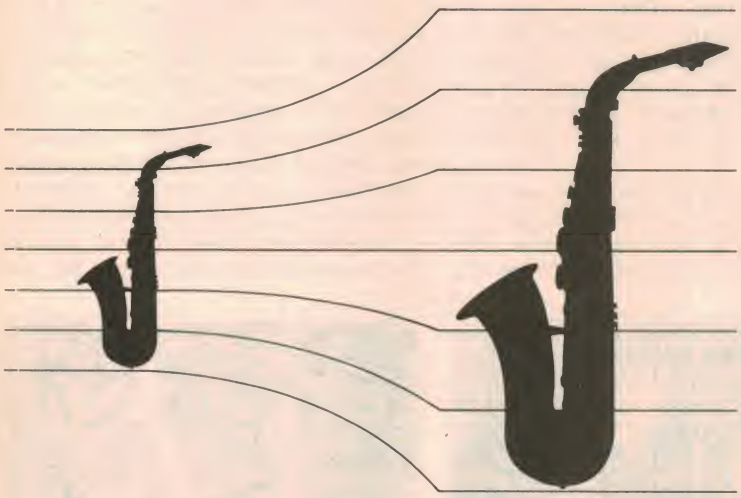
Unfortunately, even with the aid of all the information on the record, we were unable to determine accurately the onset of mistracking. The three tones combine to produce a sound which, if anything, masks the sound of the cartridge mistracking rather than enhances it. The first demonstration by Shure of mistracking on the test record shows this problem clearly.

This is surprising, for a great deal of emphasis is placed upon the results of this trackability test by Shure. In fact it is this test more than any other, which is supposed to show the superiority of the Type V over other cartridges. To attempt to do this with a test that does not give clear cut results seems strange indeed.

Despite repeated comparisons between the two demonstration tracks, one "with mistracking" and one without, we

These alignment gauges allow adjustment for minimum lateral tracking distortion (left) and ensure that the headshell is parallel to the record surface (right).

How to get 50% more sound without turning up the volume.



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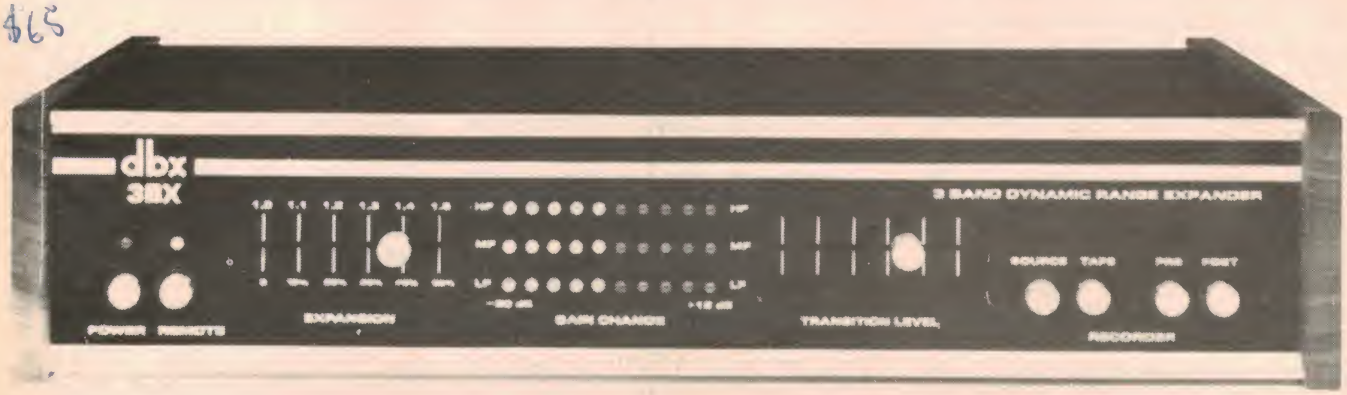

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could not pick the difference. All who heard the tones remarked that they sounded "woody" or harsh by their very nature. Nor could we pick any difference by close examination of the signals with the aid of an oscilloscope. We had two samples of the record, by the way, and they were identical in this respect.

With the final test on the record, the tonearm resonance test, we had trouble finding the resonance. This was mainly due to the effectiveness of the dynamic stabiliser fitted to the Type V which damped the resonance peak to the point where it was virtually unnoticeable. The dynamic stabiliser brush must be regarded as one of the best features of the Type V for not only does it reduce the effects of warps and resonances very effectively, it also cleans the record and helps neutralise static charge at the same time.

To gauge the tracking ability of the V-15 Type V we used more conventional test records than the TTR117, these being the CBS STR110, the W&G 25/2434 and the Shure Audio Obstacle Course-ERA III. Played with the dynamic stabiliser on, and at the recommended tracking force of 1.5 grams (corresponding to a one gram force on the stylus tip), the Type V coped with all but the most severe peaks on each record. These were the +18dB 300Hz test on the CBS STR110, the +16dB drum beat on the W&G 25/2434 and the level 5 violin track on the Shure ERA III.

Clearly this places the V-15 Type V amongst the leading cartridges as far as tracking ability is concerned, particularly since it achieves these results with a stylus force of only one gram. The square wave response of the cartridge was also excellent – possibly the best we have seen. The small amount of ringing present on the leading edges of the square wave had a frequency of around 40kHz, definitely well out of the audio band. There was some slight rounding of the square wave but this is of little consequence.

Manufacturer's figures for the Type V are a mass of 6.6 grams, a DC resistance of 950Ω (typical) and an inductance of 330mH (typical). The recommended load for the cartridge is 47kΩ in parallel with 250pF although Shure states that capacitances between "100 and 400pF will cause neglible change" in performance.

The overall frequency response showed a drop of 3dB at 20kHz, and a small resonance peak of +2.5dB at 14kHz which appears to be caused by the electrical resonance of the cartridge inductance and the load capacitance. There was a slight mid-high frequency droop in response centered around 6-8kHz but below 1kHz the response was within 0.5dB.

Channel separation was excellent, being 30dB at 1kHz, 23dB at 10kHz and 24dB at 20kHz. The only place where adequate channel separation was not maintained was around the electrical resonance point where the separation dropped to a low 7.5dB at 17kHz. This is not good at all and may point to a small fault being present in the review model. In any case, fault or not, there still appears a need to shift the electrical resonance frequency to a point somewhere outside the audio range.

One method for shifting the resonant frequency would be to reduce the capacitive loading of the cartridge. By using the minimum value stated by Shure, 100pF, the resonant frequency could be shifted to almost 28kHz. Shifting the resonant frequency outside the audio band would be difficult, however, for anyone whose turntable leads already possessed more than about 200pF capacitance.

Output level for the V-15 Type V was measured as 0.90mV/cm for the left channel and 0.93mV/cm for the right channel, both measurements being taken at 1kHz. This represents a channel balance of 0.25dB at this frequency.

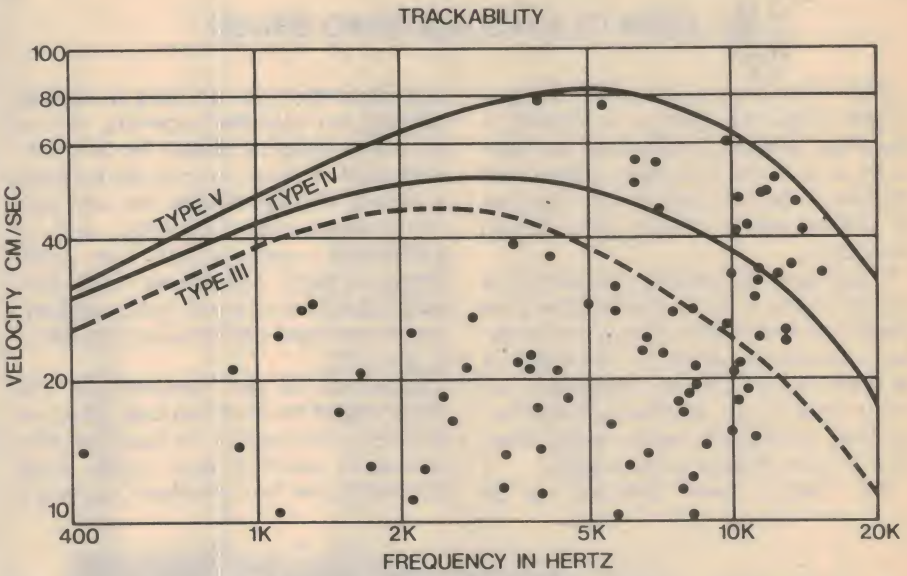
Below 10kHz there was very little distortion on sine waves, however above 10kHz it was a different story. As the test frequency approached the electrical resonance frequency, the sine wave became quite distorted. The effects of this distortion are unclear. Certainly any harmonic distortion produced will be outside the range of normal human hearing, although the same probably cannot be said for any intermodulation products that may be present.

Performance and listening tests were carried out with the V-15 Type V mounted in a variety of record player and tonearm combinations. Except for the SME Series 3 arm, there was no difference in any of the measured performance parameters of the cartridge between tonearms. When mounted in the SME tonearm, the V-15 Type V tracked marginally better but still not good enough to verify Shure's claims.

Listening tests showed that the V-15 Type V performed best in the SME tonearm, delivering a very clean, transparent sound with excellent overall balance between high and low frequencies.

To sum up our test results, we were still a little disappointed with the tracking ability of the V-15 Type V. That is not to say it isn't good – it's just not as good as the Shure literature led us to believe. (By way of comparison, no cartridge we have tested has managed to accurately track all the test records used.) Also we feel that the fequency response should have been flatter and that the sine wave distortion above 10kHz was too high. On the credit side the dynamic stabiliser worked very well, the channel separation was excellent (except at one point) and the overall sound of the cartridge (in the SME tone arm) was very smooth.

Recommended retail price of the Shure V-15 Type V is $389 which includes the TTR117 test record. Further details can be obtained from high fidelity retailers or from the distributors – Audio Engineers Pty Ltd, 342-344 Kent St, Sydney, NSW, 2000. (J.S.)



This graph shows the tracking ability of the V-15 Type V compared to its predecessors, the V-15 Type IV and the V-15 Type III. The dots represent actual recorded velocities of signals on difficult-to-track records.

Locate stations quickly & accurately

Digital readout for shortwave receivers

Want to add digital frequency readout to an AM radio or shortwave communications receiver that uses an old-fashioned analog dial? This unit features a bright four-digit LED display, 1kHz resolution, and a 0.2s update time that's fast enough to follow the tuning knob.

by JOHN CLARKE and GREG SWAIN

With today's crowded radio bands, a digital frequency readout is virtually a necessity. A digital readout not only provides an accurate indication of the tuned frequency, but also enables the operator to quickly locate stations of a known frequency.

In addition, the reading provided by a digital display is totally unambiguous, an important factor when listing to a multi-band shortwave receiver. The plethora of scales often found on analog dials can easily lead to an erroneous frequency reading, particularly when one's attention is concentrated on reception.

The "Digital Tuner Readout" to be described here can be used to update existing AM superhet receivers, or can provide a modern display for a home-built receiver. Two versions can be built: a 30MHz version suitable for use with communications receivers; and a 9.999MHz version for use with broadcast-band AM tuners. Only two connections are required to the receiver, one to the local oscillator and the other to ground.

Regardless of the version built, the Tuner Digital Readout has little effect on receiver performance. In fact, the only noticeable effect is due to the small loading on the local oscillator, causing it to shift frequency slightly. This will cause the tuning dial on the receiver to be slightly off scale but, since we are now using the digital readout, this will be of little consequence.

Resolution of the four-digit display is 1kHz over the full range of frequencies to 30MHz. For frequencies above 10MHz, the unit overranges and the most significant digit is not displayed when the range switch is set to the divide by one position. The most significant digit can be displayed simply by switching to the divide by 10 position, which gives a resolution of 10kHz.

Decimal point switching is employed in the design so that the display always indicates the tuned frequency in MHz. This facility is unnecessary if the unit is to be used only with a broadcast-band tuner.

By now, some readers will be wondering why our design appears to be so complicated. After all, why use 19 integrated circuits when an LSI chip (such as the AY-3-8112 as used in the Playmaster AM-FM Tuner-Clock) is

The Tuner Digital Readout can be used with broadcast-band AM tuners and communications receivers.

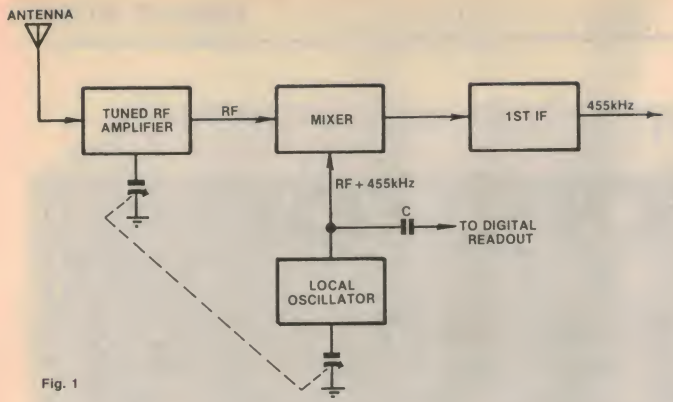


Fig. 1

Basic scheme for a superhet receiver front end. The local oscillator frequency is always 455kHz higher than the tuned signal frequency.

SPECIFICATIONS

RANGES (FULL SCALE)	0-10MHz and 10-30MHz (optional).
DISPLAY	Four digit.
RESOLUTION	1kHz with division switch set to divide by one; 10kHz with division switch set to divide by 10.
SENSITIVITY	Less than 100mV from 500kHz to 30MHz.
OFFSET FREQUENCY	Prototype set to 455kHz, but any offset frequency can be programmed.

available to do the job? The answer is that we have deliberately opted not to multiplex the LED displays, since this can cause noise problems within low signal circuitry of the accompanying tuner.

In short, the advantages of multiplexing have been rejected in favour of tuner performance. And while 19 ICs may sound a lot, the devices used are all low in cost and readily available.

Other advantages of our new design include selectable IF offset, which means that it is adaptable to almost any superheterodyne receiver. By comparison, the AY-3-8112 does not have adjustable IF offset and can only display the tuned frequency in 10kHz steps (later versions possibly have the necessary 9kHz resolution now required by the broadcast band).

At this stage, we should warn readers that the unit is not suitable for use with Wadley loop receivers or the "Electronics Australia" Deltahet receivers. Since the incoming frequency source is derived from the local oscillator, a conventional superheterodyne receiver must be used. This will include virtually all broadcast-band tuners and most general communications receivers.

Superheterodyne tuners

Before discussing the circuit operation, let's first examine the basic principle of a superheterodyne receiver.

Fig. 1 shows the general block diagram of a superhet receiver front end. The antenna feeds signal frequencies to a tuned RF stage, which selectively amplifies the particular tuned frequency. Tuning is commonly achieved by adjusting one gang of the dual-ganged capacitor, the second gang being used to control the local oscillator frequency. Both gangs work in unison, such that the local oscillator frequency is always 455kHz (the most common figure) higher than the tuned signal frequency.

Signals from the tuned RF amplifier and the local oscillator are mixed together in the mixer, the output of which consists of the original frequencies plus sum and difference frequencies. Virtually all superhet receivers reject the sum frequency and filter the 455kHz difference frequency at the first intermediate frequency (IF) stage.

It is important to realise that the tuned RF signal is not a single sine wave but consists of a range of signals centred about the tuned frequency. This range, in combination with various other factors, determines the maximum possible audio bandwidth of the receiver.

The local oscillator provides the only pure sine wave signal and it is this that is used to drive the digital readout, as shown in Fig. 1. However, the digital readout is unusual in that it is not set to zero at the beginning of a count sequence. Instead, it is "offset" (or preloaded), the amount of offset being equal to the intermediate frequency of the receiver being measured.

In other words, the circuit is basically a specialised type of frequency meter which measures the receiver's local oscillator frequency and subtracts the IF to display the actual frequency to which the receiver is tuned.

Block diagram

Fig. 2 shows the general arrangement of the Tuner Digital Readout. Essentially, it can be broken into three parts: input amplifier and divider chain to process the local oscillator signal; a crystal-controlled timebase; and a counter section.

As shown, the local oscillator input frequency is amplified and then divided by either 100 or 1000, depending upon the position of the division switch. A 4MHz crystal-controlled oscillator forms the timebase, which is divided by 80,000 to obtain a 50Hz clock signal. This 50Hz clock signal is then fed to a timing circuit to derive a 5Hz gating signal plus control signals for the counter, latch and preload circuitry.

When the division switch is in the divide by one position, the counter is preloaded with 9545, which is the appropriate offset for a 455kHz IF. Why

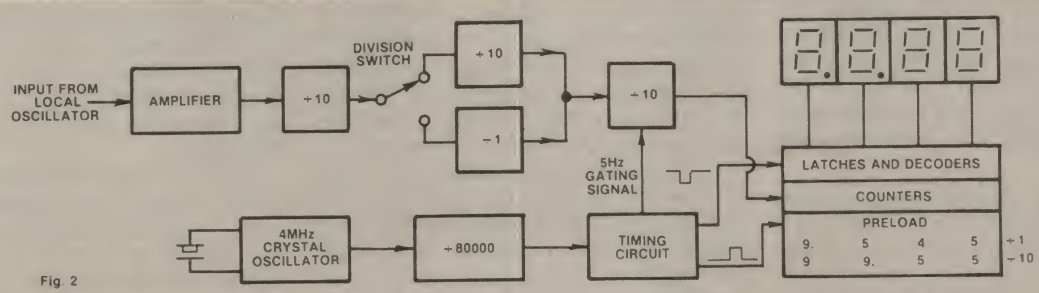


Fig. 2

The circuit is basically a DFM that is offset by an amount equal to the intermediate frequency of the receiver being measured.

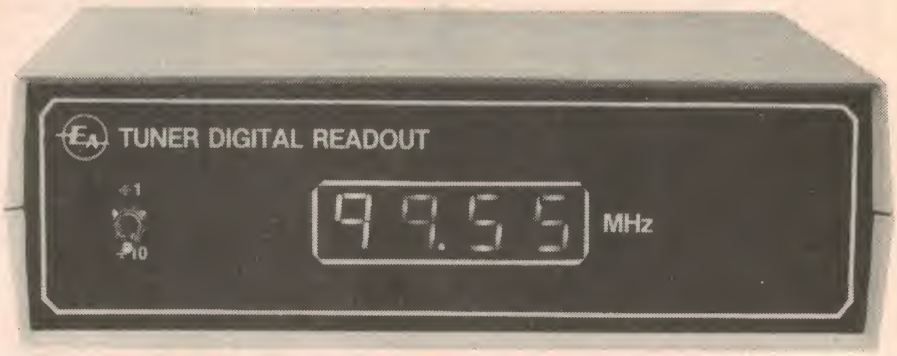
9545? The answer is that if we add 9545 and 455 we obtain 10,000 and, since the counter overranges, the display will read 0000.

By thus adding the IF to the counter preload, the counter is effectively zeroed.

Similarly, when the division switch is set to divide by 10, the counter is preloaded to 9955. This number is arrived at by rounding off the theoretical preload number of 99545 to the four most significant digits. Since counter resolution is only 10kHz in the divide by 10 position, this has no effect on the accuracy of the display.

After preloading, the gating signal allows the local oscillator signal to be counted. When counting stops, after 100ms, the latches store the BCD count and subsequently decode it to drive the seven-segment LED displays.

An example will serve to illustrate how preloading works. Let's assume that the division switch is set to divide by one and that the receiver is tuned to Sydney station 2SM on 1269kHz. The local oscillator will thus be on 1724kHz (or 1.724MHz). This frequency is fed to the counter, which counts up from 9545, on through zero and up to 1269.



This view shows the prototype displaying the divide by 10 preload value.

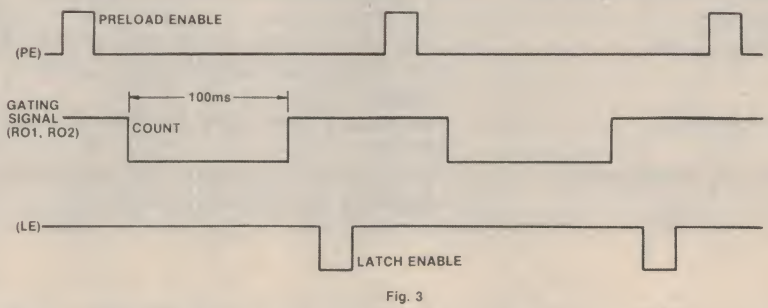


Fig. 3

These waveforms control the timing and counting operations of the circuit (see text). A full cycle takes 200ms, giving an update time of 0.2s.

Circuit details

A FET preamplifier stage and an emitter-coupled-logic (ECL) IC form the front end of the design, while low power Schottky (LS) TTL ICs are used as dividers. CMOS devices are used for the counters and decoders, however, since decoders with latching are not available in TTL.

Two separate FET preamplifiers are shown on the circuit diagram. The circuit enclosed within the dotted lines is recommended if the display is to be used with shortwave receivers, or if the leads to the local oscillator are relatively long (greater than 200mm). It is built on a separate small (38 × 24mm) PCB designed to mount inside the receiver, close to the local oscillator.

In this remote buffer stage, input signals from the local oscillator are coupled in via a 15pF capacitor to the gate of a 2N5485 N-channel FET arranged in common source configuration. The 1kΩ source resistor is bypassed with a .0047μF capacitor and this gives the stage a gain of around unity at the frequencies of interest. This is sufficient to drive the following ECL amplifier stage into clipping.

The alternative preamplifier, consisting of FET Q1, is built onto the main PCB along with the rest of the circuit. In this case, Q1 is arranged as a source follower with the gate connected to ground via a 1MΩ resistor and self-biased by a 1kΩ source load. This arrangement should work satisfactorily with broadcast band tuners, provided the leads to the local oscillator are kept short, but note that the input coupling capacitor must be increased to 47pF to compensate for the lower gain of the circuit.

The FET output is AC-coupled to cascaded ECL line receivers IC1c, IC1b and IC1a, which comprise an MC10116 triple differential line receiver IC. If this part of the circuit appears familiar, that's because an identical arrangement was used in the front end of the EA 500MHz DFM in the December 1981 issue!

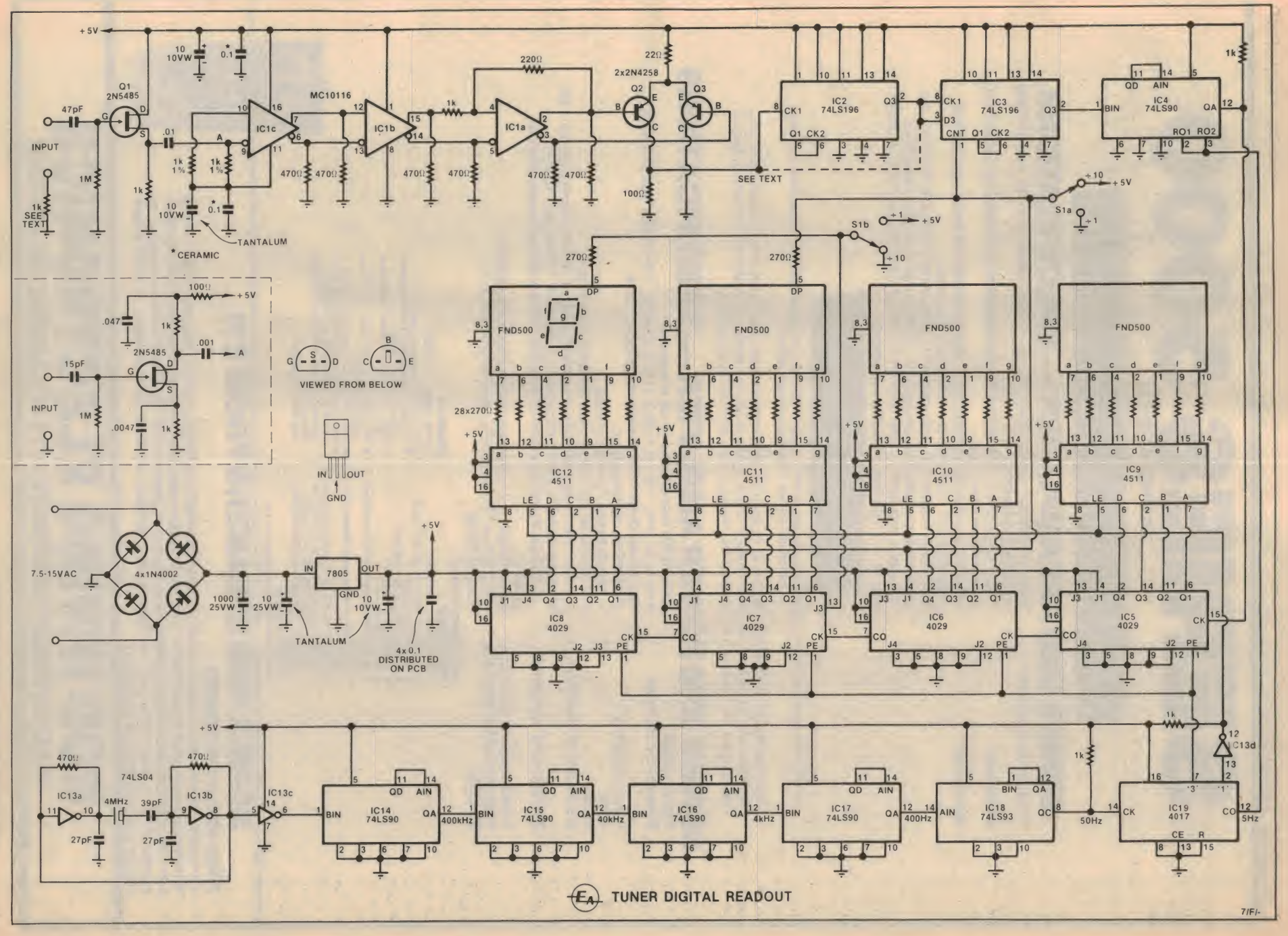
Essentially, each ECL line driver receiver consists of an NPN differential pair with a constant current source in the "tail" and resistor collector loads. The collector of each transistor is buffered by an emitter follower, which provides complementary outputs. The emitter outputs are left open, so that the ECL outputs can be ORed together to reduce the number of gates in a design. However, in this design pull-down resistors are required on each output.

ECL outputs usually swing ±0.2V about a reference voltage of around 3.7V. This reference voltage is actually provided by the 10116 on pin 11 and we have used it to bias the first line receiver, IC1c, via two 1kΩ resistors. A 0.1μF capacitor and a 10μF tantalum capacitor provide decoupling of the reference voltage.

The stage following IC1b is IC1a which operates as a Schmitt trigger by virtue of the positive feedback network consisting of the 220Ω and 1kΩ resistors. Input signals to this Schmitt trigger must exceed its two hysteresis trigger levels before the output of the trigger will change, so this stage provides a good deal of noise immunity as well as squaring up the waveform.

The ECL outputs of IC1a are converted to TTL levels by transistors Q2 and Q3, both 2N4258 high speed switching transistors. Since the ECL outputs from pins two and three swing ±0.2V about 3.7V, then either Q2 or Q3 will be on. Thus, when pin two goes low Q2 turns on and when pin three goes low Q3 turns on. Since one transister is always on, the current through the 22Ω resistor remains virtually constant at around 35mA. The output of this stage is taken from the 100Ω collector resistor of Q2 and will swing between 0.1V and 3.2V, making it directly compatible with the following TTL stage (IC2).

IC2 is a 74LS196 high speed counter which contains two separate divider circuits. The section consisting of CK1 and Q1 divides by two, while the CK2/Q3 section provides division by five. By connecting the Q1 output to CK2 the counter divides by ten and, in this configuration, will operate up to 40MHz.


+5V
Q1 2N5485
47pF
INPUT
1M
1k SEE TEXT
1k
10 10VW
* 0.1
TANTALUM
*CERAMIC
.01
1k 1%
1k 1%
MC10116
IC1c
IC1b
IC1a
470Ω
1k
220Ω
22Ω
2x2N4258
Q2
Q3
100Ω
SEE TEXT
IC2 74LS196
IC3 74LS196
IC4 74LS90
CK1
D3
CNT Q1 CK2
BIN
QD AIN
QA
RO1 RO2
S1a
÷10
÷1
S1b
270Ω
FND500
DP
28x270Ω
IC12 4511
IC11 4511
IC10 4511
IC9 4511
LE D C B A
100Ω
.047
.001
15pF
2N5485
.0047
VIEWED FROM BELOW
IN OUT GND
7.5-15VAC
4x1N4002
1000 25VW
7805
GND
4x 0.1 DISTRIBUTED ON PCB
IC8 4029
IC7 4029
IC6 4029
IC5 4029
J1 J4 Q4 Q3 Q2 Q1
J2 J3 PE
CO
CK
74LS04
IC13a
IC13b
IC13c
4MHz
39pF
27pF
IC14 74LS90
IC15 74LS90
IC16 74LS90
IC17 74LS90
IC18 74LS93
IC19 4017
400kHz
40kHz
4kHz
50Hz
5Hz
IC13d
TUNER DIGITAL READOUT
7/F/-

SERIES 5000

As designed by ETI

SERIES 5000 PREAMPLIFIER — SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat >100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted

N.B. Picture is only of original heatsink supplied with this project. Our one is tapped from the rear so that no screw heads are visible. New picture next month.

Please note that the "Super Deluxe" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product costs $1,200 to develop so that your amplifier kit would have a professional finish as well as sound. We also have a new range of rack mounting boxes which will be released soon.

SERIES 5000 POWER AMPLIFIER — SPECIFICATIONS

Power output:	100W RMS into 8 ohms (±55 V supply).
Frequency response:	8 Hz to 20 kHz, +0−0.4 dB 2.8 Hz to 65 kHz, +0−3 dB NOTE: These figures are determined solely by passive filters.
Input sensitivity:	1V RMS for 100W output.
Hum:	−100dB below full output (flat).
Noise:	−116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ±56 V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional

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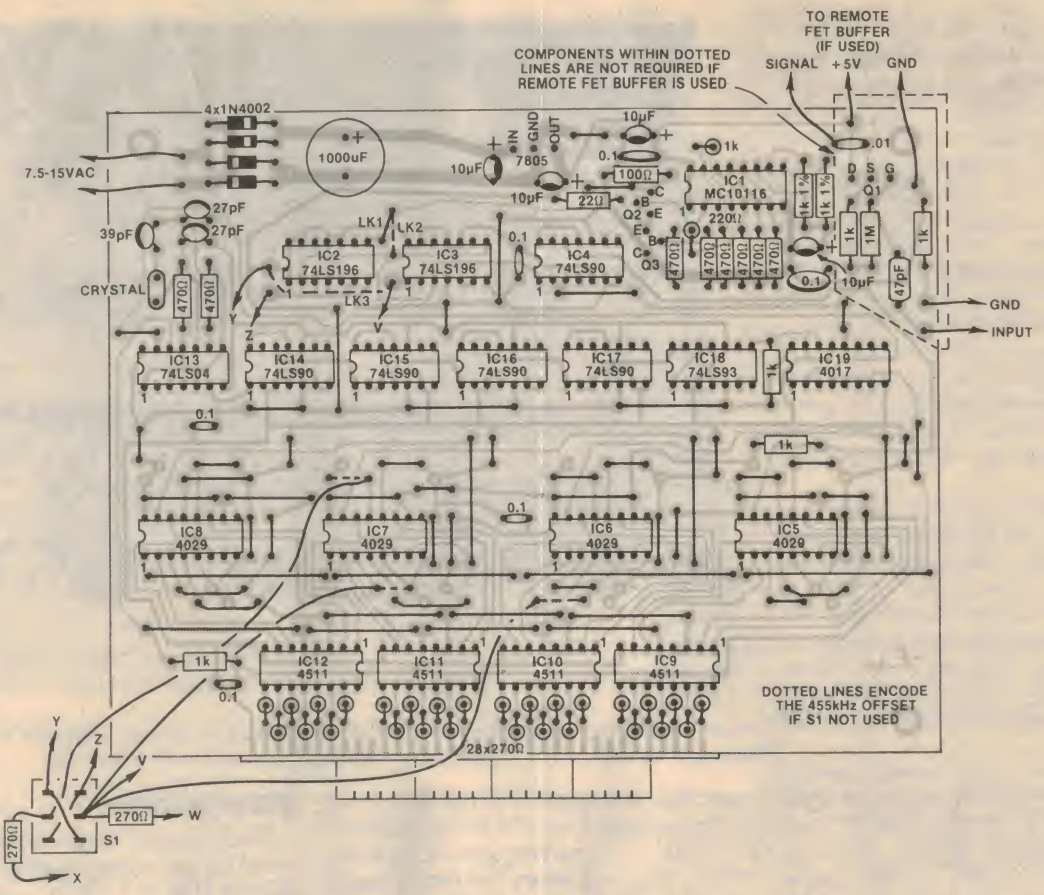
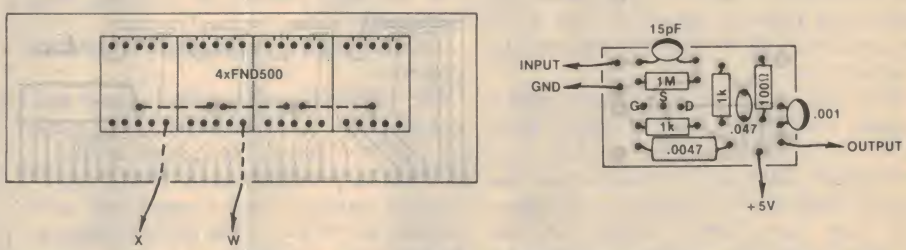


Parts layout diagram for the main PCB (30MHz version). The links shown dotted are used only in the 10MHz version.



Parts layout diagrams for the display board (left) and the remote FET buffer stage (right). Make sure that the displays are inserted the right way round.

Note that IC2 is used only for the 30MHz version. For broadcast band applications, IC2 is left out of circuit and the signal from Q2's collector applied direct to the input (pin 8) of IC3.

IC3 can be set to either divide by ten or to follow the input signal (divide by one). If IC2 is not used, then IC3 is permanently set to divide by ten. In the 30MHz version, switch S1a is used to select the division by switching the "count" input (pin 1) of IC3 either high or low. When pin 1 is held high the IC divides by ten in exactly the same manner as IC2. When the "count" is held low, the clock is disabled and the Q3 output follows the D3 input, also connected to the output of IC2. Consequently the IC divides by one.

IC4 also divides by ten. In this case, however, a 74LS90 IC is used rather that the more expensive (but faster) 74LS196 in the previous stages. The Q4 output is disabled (reset to zero) when the RO1 and RO2 inputs are brought high by the carry out (CO) of IC19, which controls the gating function. A 1kΩ pull up resistor at the output of IC4 ensures that the voltage levels of this TTL output are compatible with the CMOS clock input of IC5.

IC5, IC6, IC7 and IC8 are 4029 preset-table decade counters interconnected in a ripple clocking mode. In other words, the carry out, CO, of the first stage is connected to the clock (CK) input of the following stage and so on. These counters have jam load, or preload, inputs whereby instead of counting up or down from zero, they can count from a predetermined number. This number is loaded into the jam inputs, J1-J4, in BCD code.

When a high signal is applied to the preload enable (PE) of each counter, the binary number programmed on the J1-J4 pins is loaded into the counter. When the preload enable is subsequently brought low, the counters begin to count.

Switching between the two preload numbers is achieved with division switch S1a and S1b. In the divide by one position, J1 of IC6 and J4 of IC7 are brought to ground, and J3 of IC7 is connected to +5V. The converse applies for the divide by 10 position. In addition, the division switch is used to switch the display decimal points which are driven via separate 270Ω resistors.

The BCD outputs of the 4029 counters are decoded by 4511 BCD to seven-segment decoder drivers (IC9, IC10, IC11 and IC12). The decoder ICs read the count when the latch signal goes low and retain this count when the latch enable (LE) subsequently goes high. The decoded outputs of the ICs drive common-cathode FND500 LED displays via 270Ω current-limiting resistors.

Clock signals are derived from a crystal-controlled oscillator consisting of a 4MHz series-mode crystal and 74LS04 TTl inverters IC13a and IC13b. A 470Ω feedback resistor biases each inverter in the linear mode, so that they act as high gain amplifiers. The 39pF capacitor provides the correct capacitive load for the crystal, while the 27pF capacitors limit the maximum operating frequency of the circuit to prevent the crystal from operating in a spurious harmonic mode. IC13c buffers the oscillator output.

It is not necessary to use a trimmer capacitor to adjust the oscillator frequency, since the accuracy of the untrimmed crystal far exceeds the resolution of the display.

IC14, IC15, IC16 and IC17 each successively divide the oscillator frequency by 10. This division ratio totals 10,000, so the frequency at the output of IC17 is 400Hz. IC18 is a binary counter and the QC output provides division by eight to give an output frequency of 50Hz. Because the following IC is a CMOS device, the output from IC18 has a 1kΩ pull-up resistor.

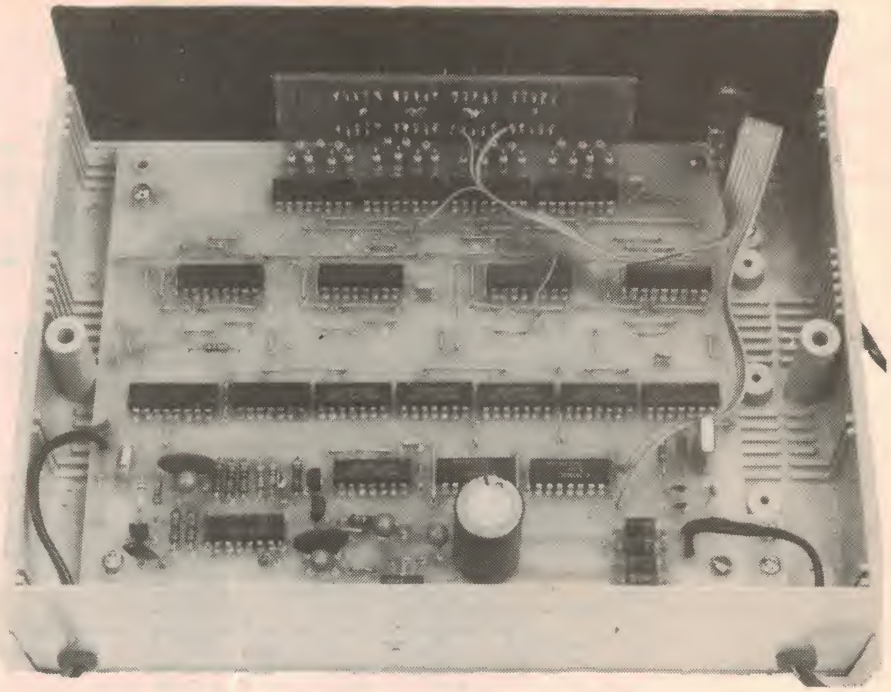
The 50Hz signal is now further divided by IC19, a 4017 CMOS decade divider with 10 decoded outputs. This IC provides the 5Hz gating signal to IC4, and provides control signals for the count and latch operations. Each of the 10 decoded outputs go high in sequence for a period of one clock cycle and we have used the "1" and "3" outputs for the latch and preload signals to the 4511 decoders and 4029 counters respectively.

Since the latch enables of the decoders require a low signal, the "1" output from IC19 is inverted with IC13d. The associated 1kΩ resistor ensures that the output from the TTL inverter is compatible with the CMOS inputs of the decoders. Fig.3 shows the waveforms used for timing the counting operation.

First, the preload enable goes high for 20ms and the counters are preloaded ready to begin counting. Then, 20ms later, the CO output (pin 12) of IC19 goes low and gates through the local oscillator signal from IC4 to the counters (IC5-IC8). This counting period lasts for 100ms, stopping when the gating signal subsequently goes high again. Finally, after a further 20ms, the latch enable to the decoders (IC9-IC12) goes low and the counted value is latched and displayed.

This cycle is then repeated for the next count.

The power supply is conventional and consists of a 7.5-15VAC plug-pack transformer driving a bridge rectifier. Filtering is provided by a 1000μF electrolytic capacitor and a regulated +5V supply rail for the ICs is derived using a 7805 3-terminal regulator. The 10μF tantalum capacitors ensure regulator stability and improve the transient response, while the 0.1μF decoupling capacitors prevent false triggering of the ICs due to supply line transients.



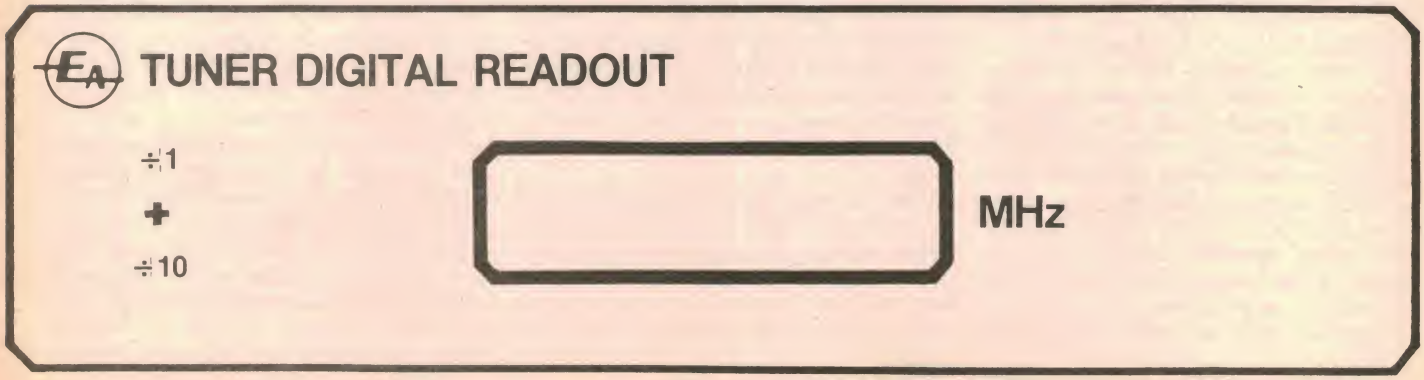
View inside the assembled prototype. Take care to ensure that the end-mounted resistors do not short connections on the back of the display PCB.

Construction

Three printed circuit boards (PCBs) are used for the wiring: a main board coded 82fc8a (160 × 125mm); a display board coded 82fc8b (93 × 33mm); and a small preamplifier board coded 82fc8c (38 × 23mm). The display board carries the four FND500 displays and is soldered at right angles to the main board to keep internal wiring to a minimum.

As explained previously, the remote preamplifier board (82fc8c) is necessary if the display is to be used with shortwave receivers or if the leads to the local oscillator would otherwise be fairly long. The preamplifier on the main board should be sufficient for most broadcast

Below is an actual size reproduction of the front panel artwork, but with the trim marks deleted so that it will fit on the page. Panel trim is 197 × 60mm.



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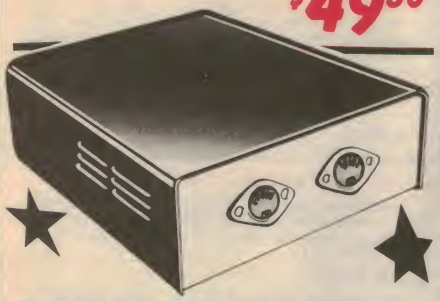

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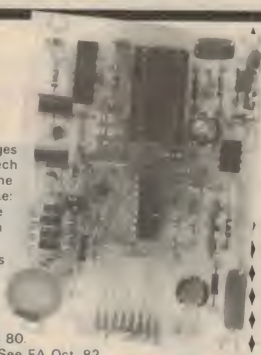
$49.50

"Compu-voice" (EA Speech Synthesiser Kit



Now you can have the advantages of a full phoneme - type speech synthesiser for a fraction of the normal cost! With features like: Unlimited vocabulary, variable pitch control (vary the speech from baritone to a soprano), easy to program AND it works with any computer fitted with a Centronics type parallel printer port such as the Dick Smith System 80 and Super 80, and the Tandy TRS 80. Fantastic value! Cat K-3530. See EA Oct. 82.

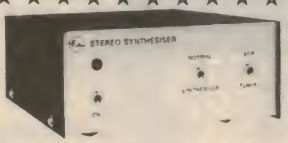
$97.50

Case to suit. Cat H-2505 only $12.50
Transformer to suit. Cat M-2851 only $3.90

FLUORESCENT STARTER

Replace your old faulty starter with this superb kit. All solid state — fits into the carcass of your old starter. This is our smallest kit ever — even the instruction manual is small! It is also one of our LOWEST PRICED kits! At this price its a steal! Cat K-3082.

ONLY **$4.80**



STEREO SYNTHESIZER

If you've compared mono and stereo sound, you'll be aware of the advantages of stereo reproduction. Now you can enjoy the benefits of stereo sound from your video cassette recorder, TV or AM tuner with this Stereo Synthesizer. Easy to build, you can choose between normal and synthesized stereo sound and between two different monophonic sound sources. Cat K-3420

ONLY **$52.50**

LCD PANEL METER MODULE

This is an economical, yet high quality and very accurate voltmeter using a large LCD for easy reading and low power consumption. Comprehensive data & instructions indicate the versatility of the single chip that this kit has been built around, (the ICL 7106).

Use as a normal panel meter for all the uses of an analogue panel meter but with the added advantage of non-ambiguous readings. The number of uses is only limited by the inventiveness of the user. Cat K-3450

ONLY **$29.50**

DICK SMITH DELUXE COUNTER

The experimenter's delight! Every hobbyist at some time needs a counter. Here's one that won't break the bank.

A deluxe fibreglass PCB with all the counter components supplied — and you can use this as a base for a huge number of projects. Operates from 5 to 15V supply. Exclusive to Dick Smith Electronics, with our own specially prepared instruction manual showing not only how to build it, but a number of experiments too! Cat K-3451

ONLY **$29.50**

YOU REAP THE BENEFIT!

LAST CHANCE TO BUILD THESE EXCITING KITS ... STOCKS ALMOST GONE!

EA METAL LOCATOR

ONLY **$19.50**

Want to make an economy detector? This must be the one. It uses the latest digital integrated circuitry, and is very simple to make. AND it won't break the bank! Significantly simpler circuitry means simpler operation too! Cat K-3504.
See EA Nov 79.

Make a bit of noise with THE HOT CANARY

Give your budgie something to worry about! This kit uses just one CMOS IC to generate the beautiful whistling and chirping of two canaries! Comes complete with zippy box and speaker. Cat K-3395
See EA May 81.

ONLY **$15.50**

SOUND LEVEL METER

ONLY **$35.50**

This great unit will measure noise in its many forms. Measures levels of less than 20dB to levels greater than 120dB with fast or slow response times. This allows you to measure peak or average levels. An easy kit to build, it's mounted in a zippy box and is battery powered. Cat K-3476. See EA May 81.

CORE BALANCE RELAY

Protect your equipment AND YOUR LIFE! This circuit breaker detects earth fault currents and then trips a relay which cuts the power. The relay cannot be reset until the fault has been corrected. The unit is portable, designed to run on 240V and comes complete with special front panel and double power outlet.
Cat K-3315. See EA April 81.

WAS ~~$52.00~~ NOW **$45**

CAR STEREO BOOSTER AMP

Upgrade the power of your car's stereo radio or cassette to 1.5 W RMS per channel! Install this unit in the existing speaker cables and connect to 12V and earth, and away it goes. Easy to build, can be matched to wide variety of stereo systems. Cat K-3493
See EA Jan 79

ONLY **$29.50**

PARTS FOR NEW KITS

FLUORO STARTER (CAT K-3082)

SCR C122E	Cat Z-4332	$1.85

STEREO SIMULATOR (CAT K-3420)

IC TL 071	Z-6030	$1.25
IC 4049	Cat Z-5649	80c
RCA Socket 6 way	Cat P-1446	$1.70
Transformer 2155	Cat H-2155	$5.95

DC-DC CONVERTER (CAT K-3278)

F x 22402 pot core/pair	Cat L-1436	$4.85
Bobbin to suit above	Cat L-1437	45c
Case TUO-3	Cat H-2744	$6.20

COMPUVOICE (CAT K-3530)

SCO1 Speech Synthesiser chip	Cat P-2670	$69.50
IC 74LS 367	Cat Z-5292	$1.00
IC 74121	Cat Z-5260	80c
Volt/reg 7812	Cat Z-6552	$1.30
Volt/reg 7805	Cat Z-6545	$1.30

3 DIGIT COUNTER (CAT K-3451)

Display 7 seg. FND 500	Cat Z-4150	$1.40
IC 4511	Cat Z-5730	$1.60
IC 4029	Cat Z-5629	$2.00

FLUORO INVERTER (CAT K-3275)

7 way tag strip	Cat H-6407	25c
5 pin din plug	Cat P-1550	85c
5 pin din socket	Cat P-1552	65c

CAR COMPUTER REMOTE (CAT K-3405)

IC socket 14 pin DIL	Cat P-4140	32c
Display 4117	Cat Z-4117	$1.85
Clock case	Cat H-3194	$4.99

POWER SUPPLY 13.8V 10A (CAT K-3452)

Bridge rectifier PA40	Cat Z-3334	$5.25
Transistor Tip 32	Cat Z-2024	99c
Transformer 2000	Cat M-2000	$19.95
Case (metal)	Cat H-2455	$20.50

DICK SMITH Electronics

bankcard welcome here

Terms available to approved applicants through HFC

SEE PAGE 98 FOR ADDRESS DETAILS

DSE/A356/PAI

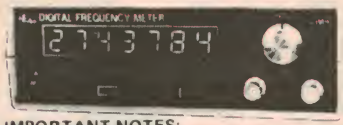
MOVE OVER HEATHKIT

Yes, we all know that the world's best selling Electronics Kits are from HeathKit – and with good reason – great design, premium quality components, comprehensive step by step instructions etc. **Well, we've taken a leaf from their book** *with our new range of kits and while an ALTRONICS kit may cost a dollar or so more* **– just check the benefits to you, the enthusiast constructor, premium grade semis such as Philips, Fairchild and Motorola, full easy to follow assembly instructions and every last nut and bolt supplied – even solder!** *So when you buy one of these kits you can do so with confidence. Cheers.* Jack O'Donnell

DIGITAL FREQUENCY METER

See Electronics Aust. Mag. Dec. 81-Feb. '82

500 MHZ, 7 DIGIT RESOLUTION PLUS PERIOD MEASUREMENT FEATURE



IMPORTANT NOTES:
(1) This project is well within the scope of the "not so experienced" as virtually all components are contained on a single PCB.
(2) ALTRONICS USE ONLY THE SPECIFIED INTERSCIL LSI — BEWARE OF INFERIOR KITS THAT DO NOT CONFORM TO THE ORIGINAL DESIGN.

* Prepunched and screened front panel, no drilling or filling required. * Bright high efficiency 7 segment display. * Frequency ranges 0-10MHz, 0-50MHz, 10-50MHz (with optional pre-scaler) * 4 gating times — 01, .1, 1, 10 seconds. * 4 period measuring ranges 1, 10, 100 and 1000 input cycles give 0.1uS resolution. * High input sensitivity — 10mV to 30MHz, 100mV at 50MHz @ 1M input impedance, 200mV at 500MHz @ 75 ohms input impedance. * High accuracy — typically better than .005% count uncalibrated.

Costs a fraction of commercial counters.

EXCLUSIVE ALTRONICS KIT FEATURES:

* IC sockets provided throughout.
* Low aging 10,000 MHZ XTAL.
* Thermalloy heatsink for 5V regulator.
* Quality Pactec Instrument Case

K 2500 (50 MHZ version) **$119.50**
K 2501 Pre-scaler . . . . . **$ 26.00**
(add for 500 MHZ version)

* THE EVER POPULAR * MUSICOLOUR IV EA PROJECT

Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.

K 1004 . . . . . **$79.50**

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION

Petrol $2.00 a gallon – Good Grief!

Yes, it's bad enough paying $2.00 a gallon for petrol without waisting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop. Easy to build!

K 1010. . . . . **$35.00**

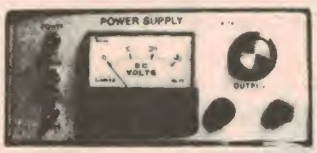
FUNCTION GENERATOR WITH DIGITAL DISPLAY

EA's new Function Generator covers the frequency range from 15Hz to 170kHz in three ranges with coarse and fine frequency controls. An economical 4-digit display has been incorporated to eliminate dial calibration. Sine wave distortion can be trimmed to around 0.5%.
See EA April, 1982

K 2505 . . . . . **$85.00**

ALTRONICS POWER SUPPLY

BASED ON EA LM 317K PROJECT
Every workshop, school and hobbyist should get one now!



* Overload and short circuit protected.
* Full voltage and current metering.
* 3-32 volt output at 1 AMP.
* Uses LM 317K variable regulator.
* Full instructions and every last part included.

VALUE PLUS!

K 3200 . . . . . **$39.95**

DIGITAL CAPACITANCE METER

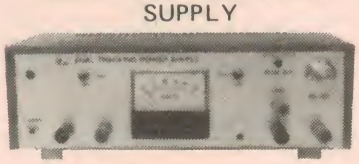
Electronics Australia Project. Measures 1PF – 99.99 UF. 240V Mains Powered. Bright LED Display. Easy to build. Complete kit of parts and full instructions.

• • • EXCLUSIVE TO ALTRONICS • • •

Each kit now includes precision measured capacitors for accurate calibration of each range.

K 2520 . . . . . **$45.00**

DUAL TRACKING POWER SUPPLY



+ 1.3 to + 22V . 2 AMPS + 5V @ 0.9 AMPS

Unit is fully protected against short circuits, overloads and thermal runaway. Pos and Neg supplies track within 1MV, voltage adjustable to within 10MV.

* Uses .25% linearity 10 turn pot.
* High sensitivity meter.

Essential for every school, workshop and lab. **Easy to build!**

K 2507 . . . . . **$86.00**
See Electronics Australia March 1982

GREAT NEW MOSFET PA AMPLIFIER KIT FROM ETI 150 watts power output.

See June '82

UNCONDITIONALLY STABLE - SOUND STUDIO SPECIFICATIONS

OUTPUT IMPEDANCE Selectable to low Z voice coil or 100V or 70V line out.
INPUTS 2 mic inputs HI or low Z with speech filter.
1 Aux. input.

* Low noise 5534 op amps used.
* Noble W/wound power resistors used in output stage for guaranteed stability.

*** * * ALTRONICS EXCLUSIVE * * ***

All due respects to ETI, but we felt the original case was lousey — So we've brought out ours utilising our snazzy H 0400 Black Rack Cabinet.

It looks terrific!! And for this month only, it's the same price as the original version.

K 5035 . . . . . **ONLY $239.00**

GO ANYWHERE 240V PWR. KITS

See EA May and June 82. These great new inverter kits enable you to power 240V appliances for your car, caravan or boat. (From Standard 12V car battery.)

40 WATT

Suits small appliances, i.e. turntable, tape deck, shaver etc. Variable frequency adjustment enables accurate speed control of turntable motors.

IC Sockets Provided

K6700 . . . . . **$55.00**

300 WATT

Fully regulated and overload protected XTAL locked frequency.

* * * * *

NOW USING HIGH EFFICIENCY C-CORE TRANSFORMER

* * * * *

Use to power hi-fi, TV sets and for emergency lighting.

* Gold plating on both PCB edge and edge connector.
* Low age rate parallel resonant XTAL used.
* Sockets for all IC's.

K6750 . . . . . **$199.50**

$10 DELIVERY ANYWHERE IN AUSTRALIA!

ALTRONICS

For Address, Phone No. and Despatch details see our Double Page Advertisement pages 30/31.

PRICES SLASHED

with Premium Grade Quality Imports from Altronics

Why Pay More?

Powerful New 6000 RPM Mini Drill for PC Work

Tons of Torque. Just the shot for PCB work. 12V DC operated from external Power Pack 1.2mm chuck capacity. Supplied c/w 1mm drill bit.

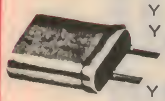
T2302 . . . . $12.95

Drill Bits:

T2320 (0.8mm) . . . $1.25

T2325 (1.0mm) . . . $1.25

CRYSTALS



Y 1000	1·000	5mm Pinout	11.50
Y 1003	1·8432		9.50
Y 1006	2·000		7.50
Y 1010	3·57945 Solder Type		3.00
Y 1012	4·000	12·3mm Pinout	5.00
Y 1015	4·194		5.00
Y 1017	5·000		5.00
Y 1018	6·000		5.00
Y 1019	8·000		5.00
Y 1020	10·000		5.00
Y 1025	12·000		5.00
Y 1030	16·000		5.00

Parallel Resonant

Frequencies Quoted in MHZ

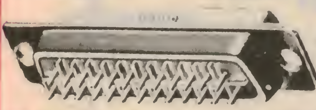
D25 SERIES CONNECTORS

Universal 25 Pin Computer Series

P 0900 Male 25 Pin . . . ~~$5.50~~ NOW $3.95

P 0901 Female 25 Pin . . ~~$5.50~~ NOW $4.50

P 0905 Backcover . . . ~~$3.50~~ NOW $2.50



SAVE NEARLY 30%

VINYL BINDER

Holds 12 magazines, each on a spring out wire rod. Just the shot for each year's set of Electronics Australia, ETI or any of your favourite magazine.

Suits all A4 size publications (275 x 210). Very smart Royal Blue colour with beautiful gold embossing.

B 9999 . . ~~$5.50~~

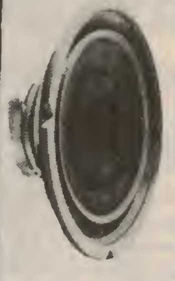
THIS MONTH

$5.00 each

4 or more $4.50 each

Incredible Value Dainichi Loudspeakers

DAINICHI WIDE RANGE 25 Watt

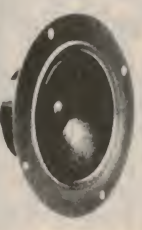


200 mm (8 in.). This superbly smooth high power speaker comes from Dainichi, one of Japan's finest speaker manufacturers (they produce OEM Speakers for Pioneer). Max. input power 25W 8 OHM Z. Resonant fo 60 HZ. Huge 10 OZ Magnet frequency response 40 HZ-18 KHZ.

C 2001 $19.50

4 or more $17.00

CONE TWEETER 50 WATT

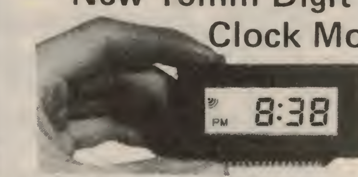


50 watt max. power 8 OHM Z. Amazing performance budget price. Frequency response 2 KHZ-18 KHZ. 110 mm Diam. Hole centres 79 mm. Australia's best value at this price.

C 3020 . . . . $7.50

4 or more $7.00

New 10mm Digit LCD Clock Module



Uses the new NEC UPD833G LSI and quality EPSON LCD display.

Size 60 x 38 x 10mm, operates from 1.5V DC. Display selectable to 12 or 24 hour format. AM/PM Display.

Inbuilt control timer selectable to 15, 30, 60 and 120 minute intervals.

Stop watch facility to 24 mins duration. Alarm timer, Snooze timer, Sleep timer. An incredible diversity of applications. i.e. clock radio, travellers watch, stop watch. digital alarm clock, sleep timer, snooze timer, appliance timer, sequential controller, dual time clock.

And the best news is the low price!

Y 1020 . . . . $16.50

MINI TOGGLE SWITCHES

OEM QUALITY 250V 2 AMP RATED

		PRICE	10 UP
S 1010	SPDT	$1.20	$1.00
S 1025	SPDT Centre off	1.40	1.20
S 1020	DPDT	1.40	1.20
S 1030	DPDT Centre off	1.95	1.75

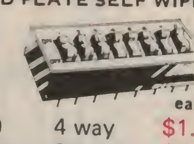
WEATHERPROOF SIREN HORN

12V DC operated — Deafening Siren Wail. Super handy for audio signalling, security systems etc. Current drain 500MA approx. Completely weatherproof. Attractive off-white PVC finish.

S 5058 . . ~~$19.50~~ NOW $15.00 ea.

DIL Switch Bargains

GOLD PLATE SELF WIPING CONTACTS



		ea.
S 3050	4 way	$1.25
S 3060	8 way	$1.75

PIEZO ALARM

Similar to "Sonalert" type. Absolutely ear piercing sound. Recommended voltage 5-15V DC. Ideal for almost all audio signalling applications. i.e. fire, water and gas signalling, computer alarms, etc.

S 5066 . . . ~~$4.95~~ NOW $4.50 each

KEY OPERATED SWITCH

19.5mm mounting hole required. Supplied with two keys. Hundreds of applications for security type applications.

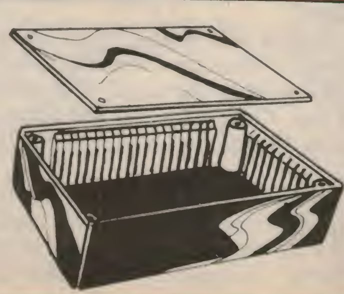
S 2500 . . . . ~~$6.95~~

NOW ONLY $5 EACH

ALTRONICS JIFFY BOXES

Incredible savings

Black plastic body with 22 g. aluminium lid and 4 st. screws supplied. These utility boxes are used in dozens of E.T.I. and E.A. projects.



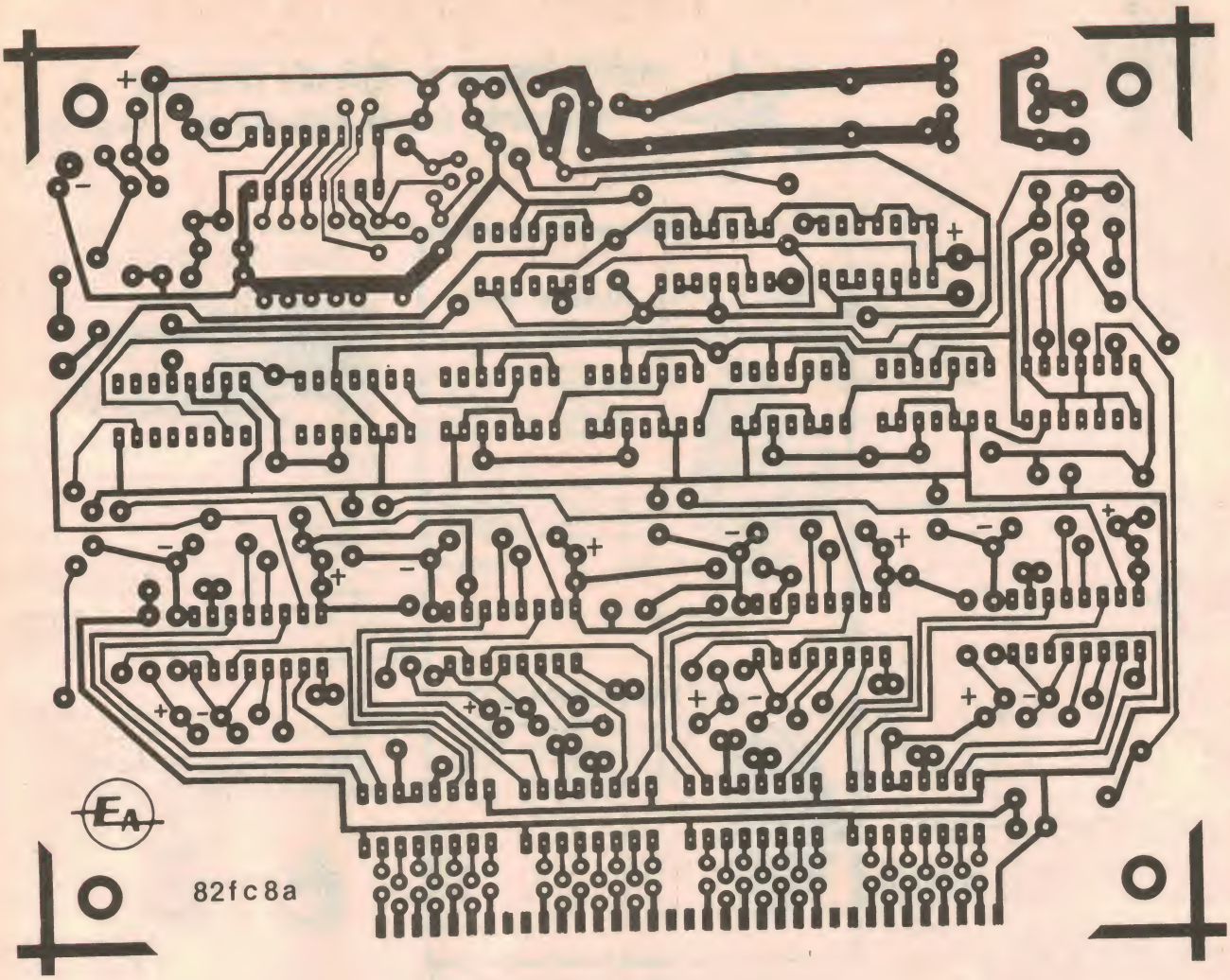
Box	Dimensions	Were	Now	10up
H 0101	150x 90x50	$2.75	$2.45	$1.90
H 0102	195x113x60	$3.75	$3.40	$2.90
H 0103	130x 68x41	$2.20	$1.85	$1.60
H 0105	83x 54x28	$1.50	$1.25	$1.00

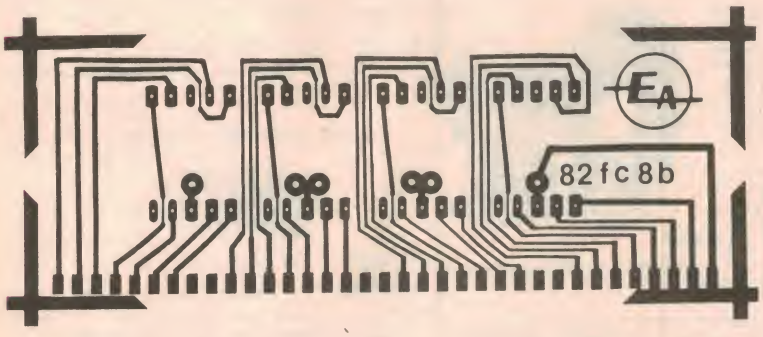
MINI BUZZER 5-15V DC

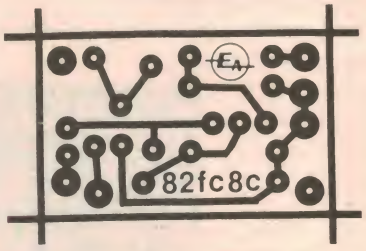
Handy little solid-state audio "Buzzer" or signalling device. Just the shot for communicator panels, or for timer alarms or in the car. Polarity conscious.

S.5062 . . . $1.00

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...







Here are actual size reproductions of the three printed circuit boards.

band applications, provided that the interconnecting leads are kept short.

Start construction by assembling the main PCB (82fc8a) according to the parts overlay diagram. If the remote FET buffer stage is to be used, then the components enclosed by the dotted lines should be left out. Install link LK1 for the 30MHz version, but do not install any of the links shown dotted.

For the 10MHz version, omit IC2, switch S1 and link LK1, and install all the links shown dotted on the overlay diagram. These include LK2, LK3, and the three preload encoding links located above and below IC6 and IC7. In addition, pin 5 of the most significant digit should be connected to +5V via a 270Ω resistor so that the decimal point is displayed.

As shown, the dotted links adjacent IC6 and IC7 encode a 455kHz offset (or preload) if S1 is not used. This preload value can be altered to any value the reader wishes (if necessary), as explained later.

Although LS TTL ICs are specified in the parts list, standard TTL devices may be used if LS versions are unobtainable. Standard TTL draws about three times the power of LS versions and, if used throughout, an extra 100mA will be drawn by the circuit.

All the ICs face in the same direction except for CMOS ICs 9, 10, 11 and 12. When soldering the CMOS ICs, solder the power supply pins (8 and 16) first to enable the internal static protection diodes. The barrel of your soldering iron should be connected to the earth track on the PCB with a small clip lead before soldering.

The CMOS ICs are recognised by their 4029 and 4511 type numbers.

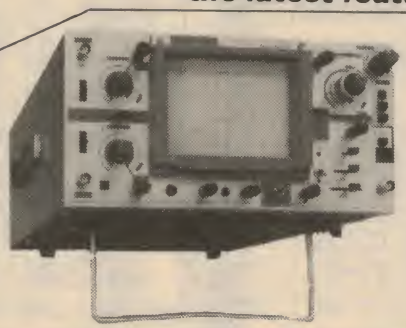
Note that many of the resistors are

THINKING ABOUT BUYING A SCOPE?

FOR PERFORMANCE & VALUE AARON HAS TO BE YOUR FIRST SCOPE CHOICE

All these scopes are dual trace and incorporate the latest features such as high brightness rectangular CRTs.

SIGNAL AND TIMEBASE DELAY

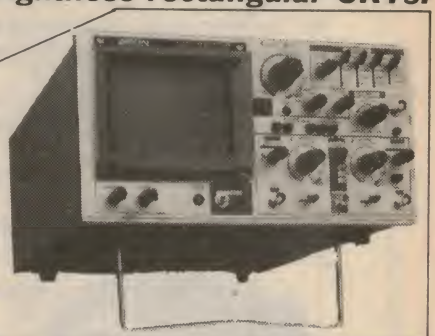


- 7.7nS risetime
- Single sweep
- Trigger delay
- TV sync
- X-Y, dual, chop, add, subtract etc.

45MHz/1mV

BS625 $990.00

ALTERNATE AND DELAYED TIMEBASE

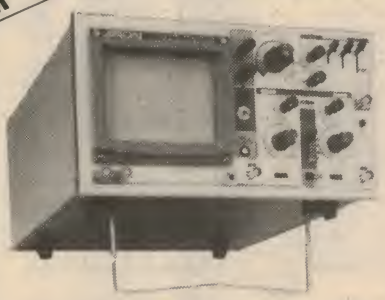


- 21 range timebase
- 100mS-1 uS trigger delay
- Front panel trace rotate
- X-Y, dual, chop, add, subtract etc.

35MHz/1mV

BS635 $790.00

BUILT-IN COMPONENT TESTER

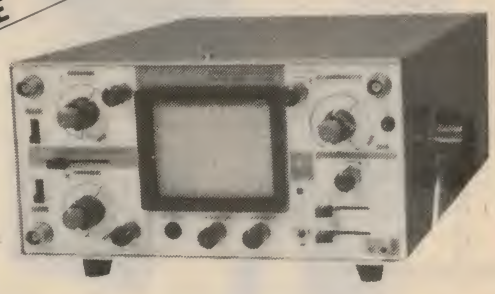


- Check components on screen
- 19 range timebase
- Triggerable to over 30MHz
- 17nS risetime

20MHz/5mV

BS601 $550.00

BATTERY PORTABLE



- 2 hour operation from built-in NiCad battery
- Automatic recharging
- Auto trigger free run
- TV sync

15MHz/2mV

BS301 $720.00

AARON

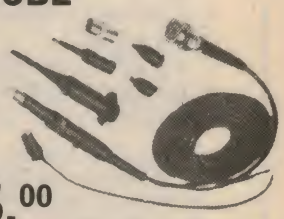
QUICK SPEC CHECK

MODEL	B'WIDTH	SENS	SIG DEL	TRIG DEL	SCREEN	T'BASE
625	45MHz	1mV	Y	Y	150mm	0.2uS - 0.5S/div
635	35MHz	1mV	N	Y	150mm	0.1uS - 0.5S/div
601	20MHz	5mV	N	N	150mm	0.5uS - 0.5S/div
310	15MHz	2mV	N	N	95mm	0.5uS - 0.5S/div

All prices are plus sales tax if applicable and subject to change without notice

COLINE SP100 PROBE

Professional 100MHz probe offering x1, ref, x10 positions. 1.5m lead with BNC connector and selection of tips. Complete in heavy duty plastic pouch. **$25.00**



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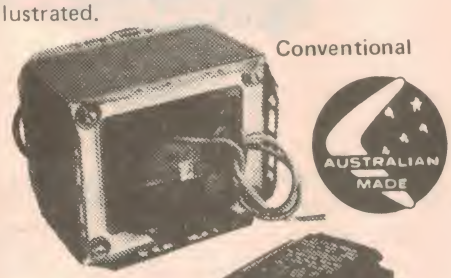
TRANSFORMER SELECTION GUIDE

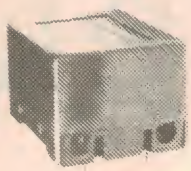
This selection guide covers transformers for connection to 240V, 50Hz mains with secondaries from 1.5 to 115V.
All are designed to Australian Standard C126 or the relevant clause of that standard as applicable.
They are all manufactured in Australia.
Prefixes indicate the method of construction – popular types being illustrated.



Conventional

Plug Pack Adaptor

Low Profile.



Printed Circuit

Many of the transformers have twin secondaries enabling different voltages/currents to be obtained from the same transformer. Many are also suitable for centre tapped configurations and these are denoted by an asterisk. The column headed VA relates to total VA of the transformer concerned and should not be exceeded.
If no suitable transformer is listed, we would be pleased to discuss your requirements and quote.

- Power, Auto & Step Down Transformers.
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VOLTS	AMPS	TOTAL V.A.	TYPE NO.	CONSTRUCTION
1.5	1.11	20.0	PL1.5-18/20VA	LP
	2.22	20.0	PL1.5-18/20VA	LP
3.0	1.11	20.0	PL1.5-18/20VA*	LP
	2.22	20.0	PL1.5-18/20VA	LP
	8.0	120.00	PF3788	C
4.0	1.0	6.0	PPB4/1000	PA
4.5	1.11	5.0	PL9/5VA	PCB
	1.11	20.0	PL1.5-18/20VA	LP
	2.22	20.0	PL1.5-18/20VA	LP
6.0	0.4	2.5	PF2851	C
	0.83	5.0	PL12/5VA	PCB
	1.11	20.0	PL1.5-18/20VA*	LP
	2.22	20.0	PL1.5-18/20VA	LP
	3.33	20.0	PL12/20VA	LP
	4.0	120.0	PF3788*	C
	6.67	40.0	PL12/40VA	LP
	10.0	60.0	TS6/60B	E
7.5	0.67	5.0	PL15/5VA	PCB
	1.11	20.0	PL1.5-18/20VA	LP
	2.22	20.0	PL1.5-18/20VA	LP
	2.67	20.0	PL15/20VA	LP
	5.33	40.0	PL15/40VA	LP
8.0	1.0	6.0	PPB8/1000	PA
9.0	0.56	5.0	PL9/5VA*	PCB
	0.56	5.0	PL18/5VA	PCB
	1.11	20.0	PL1.5-18/20VA*	LP
	1.33	12.0	PL18/12VA	PCB
	2.22	20.0	PL1.5-18/20VA	LP
	2.22	20.0	PL18/20VA	LP
	4.44	40.0	PL18/40VA	LP
	6.67	60.0	PL18/60VA	LP
	10.00	120.0	PF4405	C
	10.00	130.0	PF4354	C
10.5	1.11	20.0	PL1.5-18/20VA	LP
12.0	0.2	2.5	PF2851*	C
	0.42	5.0	PL12/5VA*	PCB
	0.42	5.0	PL24/5VA	PCB
	0.5	6.0	PPB12/500	PA
	1.00	12.0	PL24/12VA	PCB
	1.11	20.0	PL1.5-18/20VA*	LP
	1.67	20.0	PL12/20VA*	LP
	1.67	20.0	PL24/20VA	LP
	3.33	40.0	PL12/40VA*	LP
	3.33	40.0	PL24/40VA	LP
	5.0	60.0	PL12/60VA	LP
	5.0	60.0	PL24/60VA	LP
	5.0	60.0	TS12/60B	E
	5.0	60.0	TS12/60VA	C
	8.0	120.0	PF3788	C
	10.42	125.0	TS12/125B	E
12.6	1.0	12.5	PF2565	C
13.5	1.11	20.0	PL1.5-18/20VA	LP
15.0	0.33	5.0	PL15/5VA*	PCB
	0.33	5.0	PL30/5VA	PCB
	0.8	12.0	PL30/12VA	PCB
	1.11	20.0	PL1.5-18/20VA*	LP
	1.33	20.0	PL15/20VA*	LP
	1.33	20.0	PL30/20VA	LP
	2.67	40.0	PL15/40VA	LP
	2.67	40.0	PL30/40VA*	LP
	4.0	60.0	PL15/60VA	LP
	4.0	60.0	PL30/60VA	LP
	8.0	120.0	PF3788	C
16.0	18.0	300.0	PF4244	C
16.5	1.11	20.0	PL1.5-18/20VA	LP
18.0	0.12	2.5	PF3787	C
	0.28	5.0	PL18/5VA*	PCB
	0.67	12.0	PL18/12VA*	PCB
	1.11	20.0	PL18/20VA*	LP
	1.11	20.0	PL1.5-18/20VA*	LP
	2.22	40.0	PL18/40VA*	LP
	3.33	60.0	PL18/60VA*	LP
	4.0	120.0	PF3788	C
20.0	0.25	5.0	PL40/5VA	PCB
	1.0	20.0	PL40/20VA	LP
	2.0	40.0	PL40/40VA	LP
	3.0	60.0	PL40/60VA	LP
	3.0	60.0	PF3993	C
24.0	0.21	5.0	PL24/5VA*	PCB
	0.5	12.0	PL24/12VA*	PCB
	0.83	20.0	PL24/20VA*	LP
	1.25	30.0	TS24/30VA	C
	1.25	30.0	TS24/30B	E
	1.67	40.0	PL24/40VA*	LP
	2.5	60.0	PL24/60VA*	LP
	2.5	60.0	TS24/60B	E
	2.5	60.0	TS24/60VA	C
	4.0	120.0	PF3788*	C
	5.2	125.0	TS24/125B	E
	5.2	125.0	TS24/125VA	C
	8.33	200.0	TS24/200B	E
	8.33	200.0	TS24/200VA	C

VOLTS	AMPS	TOTAL V.A.	TYPE NO.	CONSTRUCTION
25.0	0.5	12.5	PF2565*	C
26.0	10.0	350.0	PF3783	C
27.0	4.0	120.0	PF3788	C
28.0	4.0	112.0	PF3577	C
	10.0	350.0	PF3783	C
30.0	0.17	5.0	PL30/5VA*	PCB
	0.4	12.0	PL30/12VA*	PCB
	0.67	20.0	PL30/20VA*	LP
	1.33	40.0	PL30/40VA*	LP
	2.0	60.0	PL30/60VA*	LP
	4.0	120.0	PF3788*	C
31.0	5.0	200.0	PF4361	C
	8.0	300.0	PF4362	C
32.0	1.88	60.0	TS32/60B	E
	1.88	60.0	TS32/60VA	C
	3.9	125.0	TS32/125B	E
	3.9	125.0	TS32/125VA	C
	9.4	300.0	TS32/300VA	C
	9.4	300.0	PF4244*	C
	9.4	300.0	TS32/300B	E
	15.6	500.0	TS32/500EC	E
	31.55	1000.0	TS32/1000EC	E
32.5	10.0	350.00	PF3783	C
33.0	5.0	200.0	PF4361	C
	8.0	300.0	PF4362	C
35.0	5.0	200.0	PF4361	C
	8.0	300.0	PF4362	C
	10.0	350.0	PF3783	C
36.0	0.06	2.5	PF3787*	C
40.0	0.13	5.0	PL40/5VA*	PCB
	0.5	20.0	PL40/20VA*	LP
	1.0	40.0	PL40/40VA*	LP
	1.5	60.0	PL40/60VA*	LP
	1.5	60.0	PF3993*	C
	5.0	350.0	PF3783	C
42.0	5.0	350.0	PF3783	C
	6.0	300.0	PF4363	C
44.0	6.0	300.0	PF4363	C
47.0	6.0	300.0	PF4363	C
52.0	5.0	350.0	PF3783*	C
56.0	2.0	112.0	PF3577*	C
	5.0	350.0	PF3783*	C
58.5	5.0	350.0	PF3783	C
62.0	2.5	200.0	PF4361*	C
	4.0	300.0	PF4362*	C
63.0	5.0	350.0	PF3783	C
65.0	5.0	350.0	PF3783*	C
66.0	2.5	200.0	PF4361*	C
	4.0	300.0	PF4362*	C
70.0	2.5	200.0	PF4361*	C
	4.0	300.0	PF4362*	C
	5.0	350.0	PF3783*	C
84.0	3.0	300.0	PF4363*	C
88.0	3.0	300.0	PF4363*	C
94.0	3.0	300.0	PF4363*	C
115.0	0.26	30.0	TS115/30VA	C
	0.26	30.0	TS115/30B	E
	0.52	60.0	TS115/60B	E
	0.52	60.0	TS115/60VA	C
	1.09	125.0	TS115/125B	E
	1.09	125.0	TS115/125VA	C
	1.74	200.0	TS115/200VA	C
	1.74	200.0	TS115/200B	E
	2.61	300.0	TS115/300B	E
	2.61	300.0	TS115/300VA	C
	4.35	500.0	TS115/500EC	E
	8.7	1000.0	TS115/1000EC	E
	17.4	2000.0	TS115/2000EC	E

** Centre Tapped Secondary*
LP Low Profile
C Conventional
E Enclosed
PCB Printed Circuit Board Mounting
PA Plug Adaptor

CUT THIS PAGE OUT AND KEEP IT HANDY.

PARTS LIST

1 Pac-tec case (or equivalent), 205 × 159 × 65mm
1 printed circuit board, code 82fc8a, 160 × 125mm
1 printed circuit board, code 82fc8b, 94 × 34mm
1 Scotchcal front panel, 197 × 59mm
1 4MHz series mode crystal
1 7.5-15VAC 500mA plugpack transformer
4 6mm spacers

SEMICONDUCTORS
1 MC10116 triple differential line receiver
1 74LS196 high-speed decade counter/divider
5 74LS90 decade counter/dividers
1 74LS93 divide-by-eight counter
1 74LS04 hex inverter
4 4029 presettable decade counters
4 4511 BCD to 7-segment latch decoder drivers
1 4017 decade counter/divider
1 7805 3-terminal 5V regulator
4 1N4002 1A silicon diodes
1 2N5485 VHF FET
2 2N4258 PNP transistors
4 FND500 common cathode displays

CAPACITORS
1 1000µF/25VW PC electrolytic
1 10µF/25VW PC electrolytic
1 10µF/25VW tantalum
2 10µF/10VW tantalum
4 0.1µF monolithic
2 0.1µF ceramic
1 .01µF metallised polyester
1 47pF polystyrene
1 39pF NPO ceramic
2 27pF NPO ceramic

RESISTORS
(¼W, 5% unless stated)
1 × 1MΩ, 5 × 1kΩ, 2 × 1kΩ 1%, 8 × 470Ω, 29 × 270Ω, 1 × 220Ω, 1 × 100Ω, 1 × 22Ω.

30MHz VERSION ONLY
1 74LS196 high speed decade counter/divider
1 DPDT toggle switch
1 270Ω ¼W resistor

REMOTE FET PREAMPLIFIER
1 printed circuit board, 82fc8c, 38 × 24mm
1 2N5485 VHF FET
1 .047µF metallised polyester capacitor (greencap)
1 .0047 polystyrene capacitor
1 .001µF ceramic capacitor
1 15pF ceramic capacitor
1 1MΩ resistor (¼W, 5%)
2 1kΩ resistors (¼W, 5%)
1 100Ω resistor (¼W, 5%)

MISCELLANEOUS
Rainbow cable, hookup wire, machine screws and nuts, solder, etc.

mounted end on. These include two adjacent to IC1, and 28 adjacent to ICs 9, 10, 11 and 12. The remaining resistors are mounted in the conventional manner.

The FND500 displays are mounted on the display PCB after the three wire links have been installed. These wire links are mounted underneath the displays, so be sure to mount them flush against the PCB. Take care with the orientation of the displays – the ribbed edge of each display is the top.

Construction of the remote preamplifier board (82fc8c) is straightforward. Make sure that you insert the FET the right way round, though!

Initially, the two main PC boards were designed to suit a standard Pac-tec case. Subsequently our prototype was installed in a case from Dick Smith Electronics. This case has almost identical external dimensions but internal details are different. This necessitated the contriving of two small brackets to mount the PC board, as the photographs show.

We designed a silver-on-black Scotchcal front panel label to provide an attractive finish. Carefully affix the Scotchcal label to the smooth side of the front panel, and drill and cut the mounting holes for the division switch and LED displays. The cutout for the displays can be made by first drilling a series of holes around the inside perimeter and then filing the rectangle to shape.

Proceed cautiously with this step, periodically offering the front panel to the display board so that you can judge how much progress has been made. Always file inwards, otherwise the file may tear the Scotchcal away from the plastic panel.

Larger than life-size photo of the remote FET buffer stage.

The display PCB can now be soldered to the main board. Carefully butt the two boards together at right angles, so that the edge buses line up, and lightly solder tack the two end pads. Test the assembly in the case, readjust as necessary, then solder all the pads together. Inspect the completed assembly carefully to ensure that the resistors on the main board do not foul connections on the display PCB.

Next, complete the wiring according to the parts overlay diagrams and mount the PCB assembly in the case using 6mm standoffs and machine screws and nuts. Use rainbow cable for the connections to switch S1 and don't forget the two connections to the back of the display board. The use of PC stakes will greatly facilitate external wiring connections to the main PCB.

A heatsink is required for the 3-terminal regulator and this is provided by using a 196 × 56mm aluminium sheet to replace the plastic rear panel supplied with the case. The regulator is bolted to an L-shaped bracket which, in turn, is bolted (or rivetted) to the rear panel. Two grommeted holes provide entry for the plugpack leads and the oscillator signal leads.

With construction completed, short the signal input on the main PCB to ground and switch on. If all is working correctly, the unit should display the offset value – 9545 in the divide by one position, and 9555 in the divide by 10 position. If there is no display, or the unit appears to be faulty, check the power supply to all ICs and check carefully for any missing links on the main PCB.

Note that the input must be shorted right at the main PCB for this test, irrespective of whether you are using the on-board FET preamplifier or the remote preamplifier. It is not sufficient to short the remote ends of the input leads, since the leads could act as an antenna and pick up electrical noise from the immediate environment to give a random display. This electrical noise will be swamped when the input leads are connected to a signal source.

We estimate that the cost of components for this project is approximately

$41

for the 10MHz version (excludes case and front panel). Add $2.50 for the remote FET preamplifier and $5 for parts for the 30MHz version.

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Don't forget to remove the shorting link when you have completed your tests.

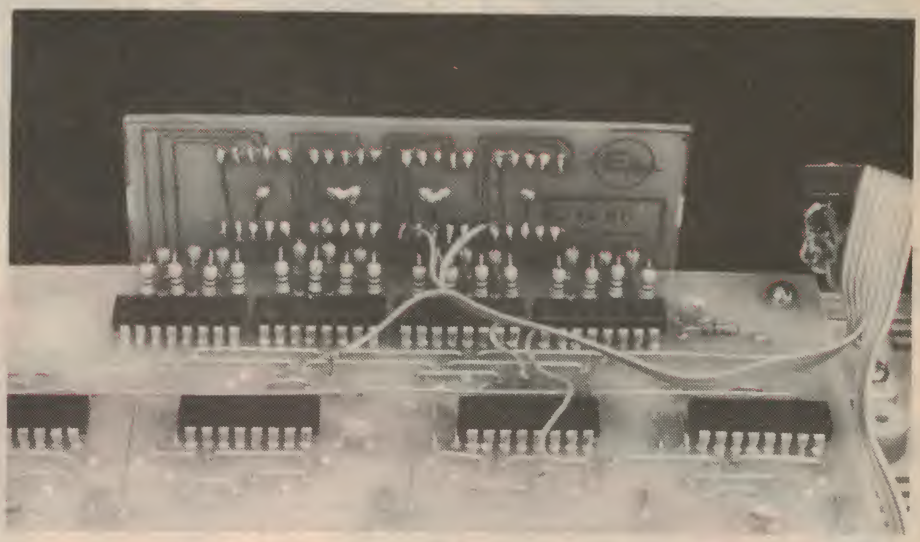
Installation

Installation simply involves connecting the signal input to a suitable point on the local oscillator of the receiver, and making the necessary ground connections. The majority of local oscillator circuits use a single transistor, although the exact circuit configuration will differ from one receiver to another. Additionally, some receivers employ separate oscillator and mixer circuits, while others employ self-oscillating mixers.

If a circuit diagram of the receiver is available, then the necessary information can be gleaned from this. If no circuit diagram is available, you will have to experiment by testing various locations around the oscillator. Generally, a direct connection to either the emitter or collector of the transistor will provide a usable signal. Select the point that affects the oscillator frequency the least.

If the remote FET preamplifier is used, it should be secured close to the local oscillator and short leads run to the oscillator output. On no account should screened cable be used to connect from the local oscillator to the buffer amplifier, since the extra capacitance will upset the local oscillator operation. Use hookup wire instead. The 1kΩ resistor in the earth leg of the on-board FET buffer amplifier was added to remove earth loop problems that may occur between the receiver and Tuner Digital Readout. Replace the resistor with a link if this problem is not evident.

Some readers may wish to alter the 455kHz preload value to suit receivers which have a different IF. To accommodate this, the main PCB has been designed so that linking can be used to select any offset required. Links from J1, J2, J3 and J4 (ICs 5 to 8) can be connected either to the positive supply rail or to the ground rail. These rails are clearly marked with + and – symbols on the track side of the PCB.



Close-up view showing how the display board is attached to the main PCB. Unused holes in the main PCB allow different IF offsets to be programmed (see text).

	J4	J3	J2	J1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Fig. 4

To calculate the preload value for the divide by one range, all you have to do is subtract the receiver's IF from 10,000 (eg. a 455kHz IF gives a preload value of 9545). The appropriate preload is then programmed into the J1-J4 pins of ICs 5 to 8 according to Fig. 4. A 5, for example, is programmed by tying J1 and J3 to +5V, and J2 and J4 to ground.

Similarly, the preload for the divide by 10 range is calculated by subtracting the IF from 100,000 and then rounding off to the four most significant digits. But it will usually not be necessary to program your own preload values. Most receivers use a 455kHz IF, so you can use the linking arrangement shown in the parts overlay diagram.

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YES! The kit you've been waiting for is now a reality. Electronics Australia's new Car Computer is the ideal way to find out how your car is performing — and how much it is costing you to run it!

Now you'll be able to check fuel consumption — instantly — and find out exactly how much damage a lead foot does to your pocket.

All those questions you ask yourself as you're driving along can be answered — electronically — in a fraction of a second ...

- How much fuel is left?
- Can I make it to the next town?
- How far have I travelled?
- How long has it taken?
- How long have I got to go this trip?
- How far have I got to go?
- How much fuel have I used/am I using/will I use?
- What's my exact speed (much more accurate than the speedo!)?

Amazing technology: how is it done?

A few years ago a device such as this would have been virtually impossible to build — especially build yourself.

Dick Smith searched the world for the most important components — the fuel and speed sensors — and the brilliant design engineers at Electronics Australia did the rest! The result: a magnificent kit which really can save you a lot of money! Simply because it can show you how to drive really economically.

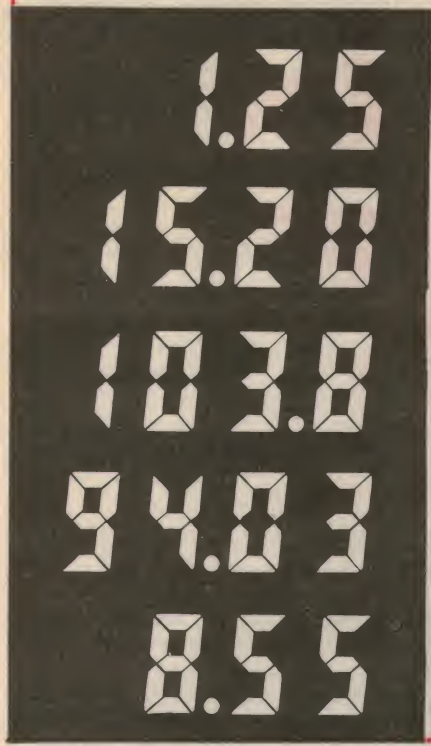
Special Computer Quality PC Board

Yes: we've not only made our board with plated through holes (as recommended by EA) we've also had a solder mask and component position overlay printed. You'll find it difficult to make an error!

Low Noise IC

We've arranged a special purchase of low-noise Schmitt trigger IC's (as used in the front end). Your Dick Smith car computer will be less prone to noise problems than other kits!

It will give you 12 different readings:



TIME

Either the time elapsed since the start of the journey (accurate to one minute) or the time remaining to complete the journey at your average speed since commencement (updated every minute or kilometre travelled).

FUEL

It will show you the amount of fuel you have used — or the amount of fuel you have left — or even how much fuel your tank can take at the moment!

DISTANCE

Your choice of distance travelled, or the distance remaining on this journey — or the distance possible with the amount of fuel you have left.

SPEED

Your exact present speed (much more accurately than your speedo can show!) or your average speed since the start of the journey.

CONSUMPTION

Either your present (instantaneous) consumption (lead footers: be prepared to be shocked!) or your average consumption since the start of your journey.

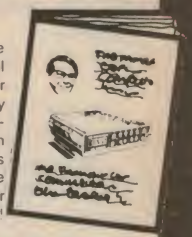
AND EVEN MORE REASONS WHY YOU SHOULD BUY YOUR KIT FROM DICK SMITH ELECTRONICS!

Exclusive!

Our unique 'Sorry Dick, it doesn't work' repair service. In the unlikely event that you can't get your kit working successfully, our Service Department will, for a fixed fee, repair, adjust your kit* as necessary to get it working properly. This fee includes all parts necessary.

*'Sorry Dick, it doesn't work' service available on specifically nominated kits, and we reserve the right to return your kit, with your service fee, should it be so badly wired or damaged as to make repair uneconomic.

Exclusive!



Our unique construction manual. We have a technical writer prepare a special step-by-step construction manual for most of our kits — so you don't have any problems. Everything is clearly and logically presented, with all construction information from the magazine — plus any other 'traps for young players' we discover along the way. We discover any problems before they affect you!

EXCLUSIVE!!! SOLE AUTHORISED AUSTRALIAN AGENTS FOR THE FAMOUS MORAY FUEL FLOW SENSOR

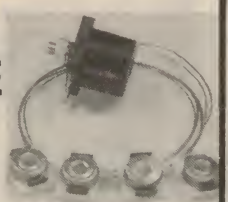
Cat. K-6100

(The one recommended by Electronics Australia)

Don't be fooled — the ONLY fuel flow sensor to give optimum results with the car computer is the fully imported 'Moray' unit. And Dick Smith Electronics are the sole authorised Australian agents for this magnificent device. It delivers an incredible 1500 pulses per 0.1 litres (other kits may be suplied with inferior sensors delivering only 130 pulses/0.1 litres). So with the 'Moray' sensor you get incredibly increased accuracy.

$69.50

DRIVELINE SPEED SENSOR



More accuracy — Easier installation

Knowing how incredibly difficult it can be to cut successfully a speedometer cable without risk of damage, we've decided to use the alternative (and, we think, much better) driveline sensor. A lot easier to install, it is not subject to the problems of speedo cables. And a further BIG advantage: when your speedo cable breaks (as they ALL do eventually) you'll still have a very accurate speedometer. (Not possible if you use the other sensor).

Cat. K-6102 **$8.25**

SPECIAL OFFER: Buy both sensors and get the speed sensor for $3.00! YES: The exclusive Moray Fuel Flow Sensor plus the Driveline Sensor at the bargain price of just $72.50! This makes the complete Dick Smith Car Computer only $166.00 — with nothing else to buy!

DICK'S PRICE $166

STOP PRESS

REMOTE DISPLAY OPTION

A number of customers have told us they'd love to own a car computer but that the project was simply too big to put on their dashboard. So we've solved that little problem ..

This is the exclusive Dick Smith Electronics car computer remote display option. It simply connects in parallel to the existing displays in the main computer (these can be disabled if you like) and also with five of the push buttons (you select the readings you want the most). And all it measures is a tiny 110 x 70 x 50mm — complete with its own mounting bracket.

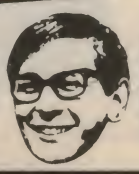
Included are the four LED displays, five push buttons and the PCB's, plus enough rainbow cable to connect it all together. If you really want to have all functions displayed, there's plenty of room on the front panel to add at least another four small push buttons. Complete with full instructions — and remember, it's not available anywhere else!

Cat K-3405

$21.50

NOTE: This important option is only available from Dick Smith Electronics

DICK SMITH Electronics



bankcard welcome here

SEE PAGE 98 FOR ADDRESS DETAILS

DSE/A312M/LM

Drive a compact car? Build this . . .

Remote display for the Car Computer

Been wondering where on earth you were going to mount the Car Computer in the crowded instrument console of your late-model compact? Well, here's an easier answer: Dick Smith Electronics has developed a neat little remote display/control option, which houses all main functions in a box only 110 x 70 x 50mm.

by JAMIESON ROWE

Coming at a time of steadily rising petrol prices and heightened awareness of the effect of poor driving habits on fuel consumption, EA's Car Computer project has created a tremendous amount of interest. Judging from the many enquiries from our customers regarding DSE's kit for the project, there are obviously many motorists keen to use it to monitor the performance of both their car and themselves.

The only problem is space. Considering the complex functions it performs, EA has squeezed the Car Computer into a remarkably compact case – it measures only 205 × 158 × 65mm. But this is still rather big when you are talking about mounting it somewhere in, or on, the instrument console of a compact modern car.

Quite a few customers have told us that they'd love to build up the Car Computer and try it out, but they just couldn't fit it into their car's console in a position where it could be used conveniently.

As soon as this problem became apparent, the technical people in our kit department started looking at the Car Computer to see if they could find a solution. After a bit of head scratching, they came up with an idea that I think is pretty neat. It's a remote display/control option, housed in the same tiny 110 × 70 × 50mm box used to house the June 1979 Car Clock kit (H-3194).

This box is so small that you should be able to fit it easily into almost any instrument console! Even sitting on the top, it's so tiny that it won't cause any problems.

Inside the box is a second set of four LED displays, which is wired in parallel with the one in the main unit so that it duplicates the Computer's readout. Or if you wish, the display LEDs in the main unit may be left out, so that the remote display works alone. If the main unit must be mounted under the seat or somewhere else out of sight, this would be a sensible move as it will give a brighter readout on the remote display.

Also in the remote box are five pushbutton switches, which are again wired in parallel with five of the buttons on the front panel of the main Computer.

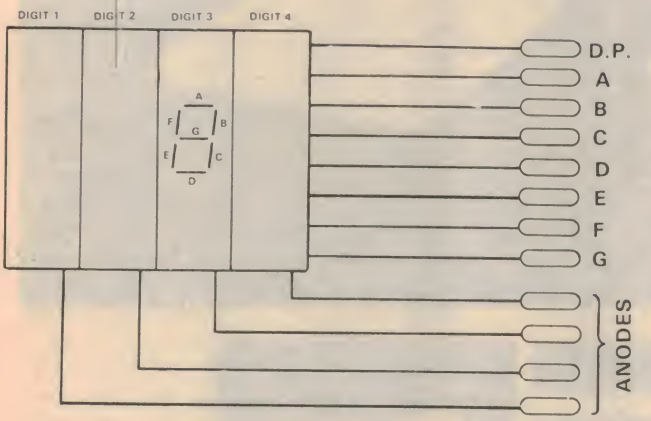
Although there are 12 buttons on the main unit, two of these are used only for initial calibration and another three are used only at the start or finish of trips. This leaves only seven, and of these five tend to be used more than the other two during typical driving. These are Hour.Min or Time (0), Litres or Fuel (1), l/100km or Consumption (4), Remaining (8) and Average (9).

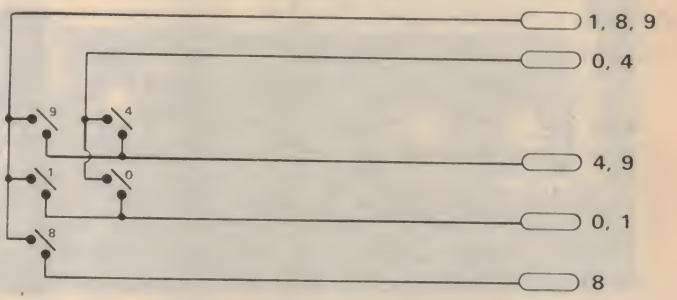
It is these five buttons that are currently extended to the remote box. However you don't have to stick with these five if you don't wish. You can use the five buttons in the remote box to perform any of the functions, just by altering the connections. And if you really must have more than five buttons on the remote box, there's room to add at least four more alongside those already there. In short, there's quite a lot of room for individual variations.

Assembling the remote box is very straightforward, as all the parts are supported by two small PC boards which also perform most of the wiring. The larger of the two boards mounts the four 7-segment LED displays, while the smaller board mounts the five

The remote display option is housed in a small plastic case measuring 110 × 70 × 50mm. Unit is compact enough to mount on virtually any dashboard!

Five functions are duplicated on the remote display unit: hour.min, litres, l/100km, REM and AV (average).





The circuit consists of four LED displays wired in parallel with the existing displays, together with five pushbutton switches wired in parallel with the five most useful function switches.

pushbuttons. Or more strictly, it forms part of the pushbuttons, as these use conductive plastic pads to link electrodes etched on the PCB itself.

As you can see from the overlay diagram for the display PCB (Fig. 2), the only things to mount on the board apart from the displays themselves are four wire links. These go underneath the displays, and therefore must be fitted to the board before mounting the LEDs.

It's even simpler with the switch PCB, as you can see from its overlay diagram (Fig. 3). There's no actual wiring at all if you elect to use the buttons for the same five functions as we have nominated. You'll only have to cut tracks and add additional wiring if you want to change their functions.

Connecting the remote unit up to the main Car Computer is also very straightforward. All you need is a length of 17-conductor ribbon cable. One end of the cable is wired to the connection points on the two remote unit PCBs, while the other end is wired to the corresponding points on the front panel PCB of the main unit. The correct connection points are shown on the accompanying overlay diagram (Fig. 1).

Using "rainbow" ribbon cable for this job helps you make the connections without errors. After making the connections at one end, jot down the colour coding you have used on a piece of paper. Then just follow the same coding at the other end, and Bob's your uncle! (as the saying goes – I've never been sure why this is relevant, even though I do have an uncle named Bob).

By the way, if you don't like the idea of the remote unit permanently connected to the Car Computer, you can cut the cable and use a suitable plug and socket combination. Although they're not cheap, a DB-25 plug and socket would be very suitable. These are sold through Dick Smith outlets as P-2690 for the plug and P-2691 for the socket, with a matching backshell for the plug available as P-2682. You could mount the socket

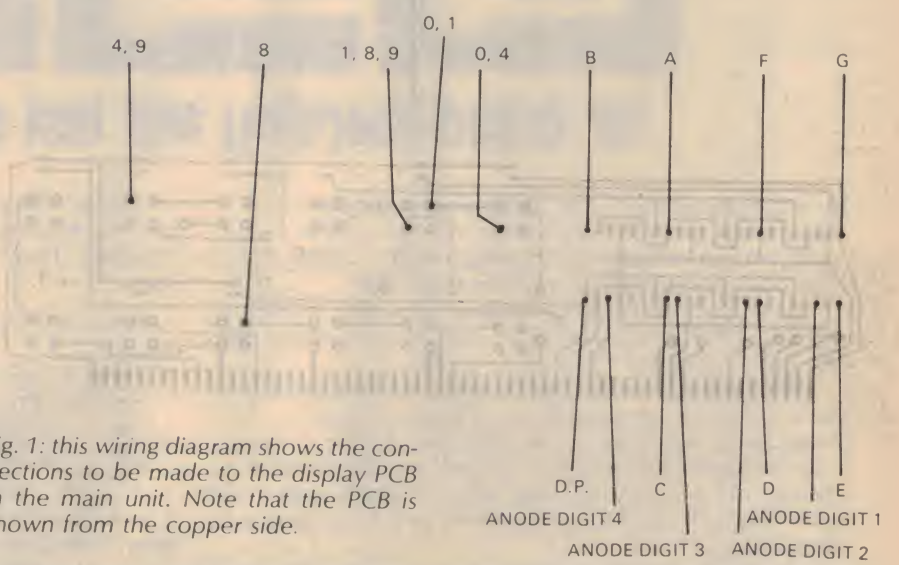


Fig. 1: this wiring diagram shows the connections to be made to the display PCB in the main unit. Note that the PCB is shown from the copper side.

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for bread-boarding and test equipment

Recently, an extensive study was conducted by an independent research organization on what product qualities most influence professionals in their choice of electronic instruments. Know what they said?

Lower price. Small more compact packages. Simpler operation. Which is exactly what our product philosophy has always been. But that's no co-incidence!

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Car Computer Remote display

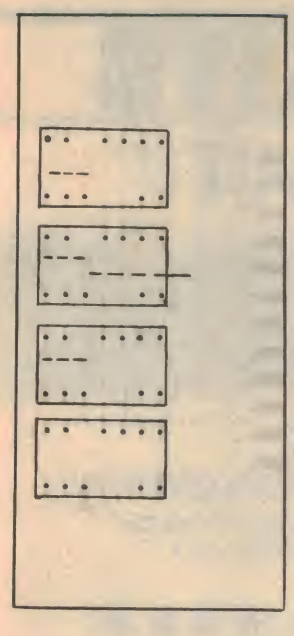


Fig. 2: parts overlay for the display PCB. When you attach the rainbow cable, write down the colours in the space provided. This will help you when you assemble the connector and also when you solder the wires to the back of the display PCB inside the Car Computer.

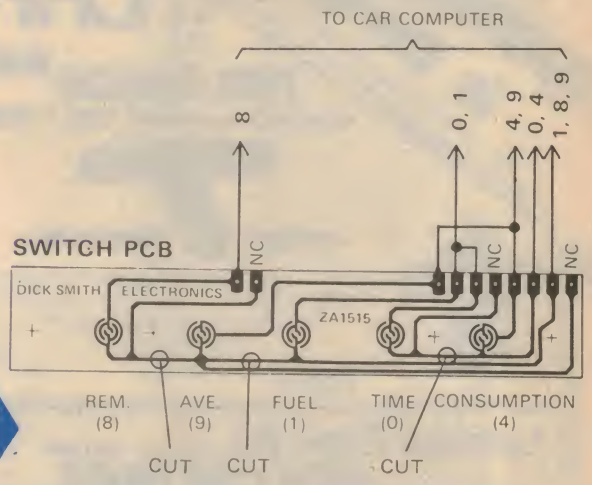
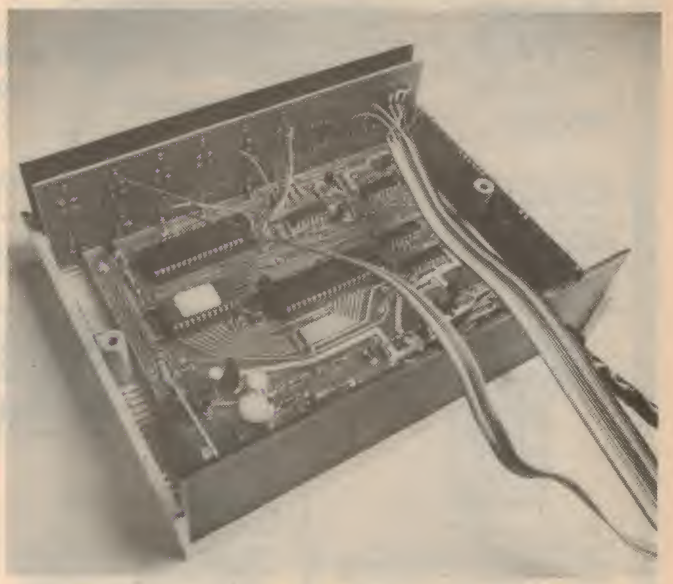


Fig. 3: wiring details for the switch PCB. Note that the copper pattern can be cut in three places if you elect to use different switches. Do NOT cut the tracks if you elect to use the same switches (ie 0, 1, 4, 8 and 9).

This view shows the prototype with the front panel removed to reveal the LED displays and the switch PCB.



Right: connections to the display PCB in the main unit are run using 17-conductor rainbow cable. Cable entry is via a slot filed in the top of the rear panel.

on the back panel of the main unit, with the cable from the remote unit terminated in the plug.

Just remember that if you use a plug and socket, you'll be doubling the chances of making a mistake with the connections. So you'll need to be twice as careful!

Extra switches

Note that if you want to add some extra buttons to the remote unit, you'll need some conventional miniature pushbutton switches. The low cost S-1102 buttons available from all Dick Smith outlets would be ideal. To mount them in the front panel you'll have to make matching 7mm diameter mounting holes, lining these up neatly with the existing buttons.

Whether or not you decide to leave the displays out of the main unit is entirely up to you. It'll probably depend on where you're planning to mount the main unit in your car, and the likelihood of you changing to a larger vehicle where you may not need the remote unit. Even if you leave them out, you can always add them in later on if you wish.

That's about it. Like all good ideas, the remote display/control option is really very simple and straightforward. It's also pretty low in cost, too, at only $19.95. But the most important thing is that it should allow many more people to obtain the advantages of a Car Computer in their car – no matter how small!

NEW STORE opening October in Carlingford

AT "NEVILLE'S CORNER" CNR CARLINGFORD & PENNANT HILLS RD. NEXT TO KENTUCKY FRIED CHICKEN

JAYCAR KITS

CAR COMPUTER KIT

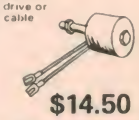
FUEL SENSOR
GENUINE MORAY UNIT ONLY $59

FROM $99.50

speed sensors

Two types available. Both operate with the EA Car Computer and give much the same results. The speedo cable unit is handy for front wheel drive or cars which have no tailshaft. This unit does require the speedo cable (outer sheath) to be cut. It does not affect the operation of the speedometer in any way and can be used with tailshaft cars also. The magnet coil unit is only really suitable for cars fitted with tailshafts, but the speedo cable is not touched

$19.50



$14.50

- FUEL ECONOMY (INSTANTLY AS YOU TRAVEL ALONG) IN LITRES/100KM.
- AVERAGE ECONOMY OVER A TRIP.
- AMOUNT OF FUEL USED SO FAR
- AMOUNT OF FUEL NEEDED (BASED ON AVERAGE USE) TO COMPLETE TRIP. ALSO TIME REMAINING.
- ELAPSED TIME
- SPEED IN K'S/HR. MORE ACCURATE THAN CAR
- DISTANCE TRAVELLED/REMAINING
- HOW FAR YOU CAN GO ON THE FUEL LEFT

Ref: JULY/AUG 82

Lyrebird Piano Kit REF: EA 11/81-1/82

NEW LOW PRICE...

$475

SAVE $50!!!

BOTH PIANO KITS FEATURE I.C. SOCKETS PROVIDED AT NO EXTRA CHARGE!!!

7¼ OCTAVE (88 NOTE) VERSIONS $589

* Stand $75 extra

Because we are shipping keyboards and other expensive components in bulk due to high demand, we can pass savings onto YOU.
You can now have a magnificent "Lyrebird" six octave touch sensitive piano for only $475!! That's a staggering $50 off the old price.
REMEMBER!! THE LYREBIRD OUTPERFORMS READY BUILT PIANOS COSTING UP TO THOUSANDS OF DOLLARS MORE. WHY PAY MORE WHEN YOUR CONSTRUCTION KNOWLEDGE CAN SAVE YOU A FORTUNE?

pricing **** information

All Electronics including both PCB's plated–through, programmed EPROM, 1% metal film resistors, high spec components and YOUR CHOICE of either speedometer cable speed sensor OR tailshaft sensor. (Please specify) **$99.50**
Pre-Punched case with, special silk screened panel and multi-way connector. $29.50
'MORAY' High resolution Fuel Sensor **$59**
IF PURCHASED TOGETHER ONLY **$159**
– WITH EXCLUSIVE LITRE/100KM–MPG CONVERSION CHART

Digital EA2/82 Thermometer

Ref: EA Feb 1982
Read the temperature in your room (or outside) from 0 degrees C to 100 degrees C in fact to within 0,1 degree C. Fantastic resolution on a bright easy-to-read display. INC CASE

$69

DIGITAL CAPACITANCE METER

Ref: EA March 1982

This kit once again uses the amazing DPM 200 LCD /driver module. Capable of measuring capacitance from 1pF to 19.99uF. It is a must in every workshop or lab.

$69

HEART RATE MONITOR

Ref: EA 7/82

NOW $69

WAS $79
SAVE $10

This unit enables you to measure your own pulse instantly and accurately. It is light enough even for joggers to carry. A must for people who may have heart problems. Complete kit including LCD Display.

NEW!!! ETI 644 DIRECT-CONNECT COMPUTER MODEM

Ref: ETI SEPTEMBER 82
Switchable BAUD RATE, more reliable and faster than most acoustic modems
All components for this unit including plated-thru PCB's and Telecom approved line coupling transformer.

ONLY $ 159

Digital Storage CRO Adaptor

Ref Feb 1982 EA

Not only can you avoid buying an expensive CRO but you can have the features of the REALLY expensive ones!!!

- Can display very slow waveforms
- One shot triggering
- Inbuilt graticle shows on TV screen
- Crystal locked timebase
- DC-100kHz bandwidth
- capable of storage operation

$110

EA dual tracking P/S

1% resistors used NOT 2%
At last!! A dual-tracking power supply with fixed +5V reg. at a reasonable price!! YOU PAY NO MORE FOR A QUALITY JAYCAR KIT!!

EXCLUSIVE!! US-MADE 10 TURN .25% LINEARITY POT used for greater accuracy

$84.50

Ref: EA March '82

NEW!!! LCD TACHO KIT ref: EA May 1982

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- USES NEW DPM–05 DISPLAY
- FITS INTO YOUR DASHBOARD
- RPM, DWELL DISPLAY

NEW!! EA STEREO SYNTHESISER

Ref: EA SEPT 82

Creats a very realistic stereo sound from AM tuners, TV or video. Very easy to build
SHORT FORM KIT
ONLY $39.50

CARLINGFORD PHONE 872 4422

-QUALITY RESULTS

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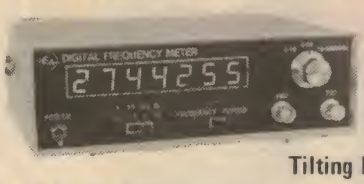
500MHz Digital Frequency Period Meter

REF: EA Dec '81 – Feb '82



Tilting Bail to suit ONLY $4.95

NOW BACK IN STOCK!!!
The best version of this kit in Australia is now back in stock. Why settle for an inferior kit at the same price as ours?
Other people may appear to be selling this kit for less. But you GET less!! Exclusive Jaycar features:

- Heavy gauge front panel. Pre-punched and silkscreened. (NOT Scotchcal).
- All metal film resistors used 1% 50ppm)
- Thermalloy heatsink for +5V regulator

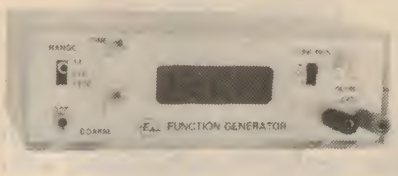
Beware of advertised units that do not conform to the original design. They may have inferior performances.

500MHz option only $26 extra
50MHz Version $119

ONLY $119

Function Generator

Ref: EA April 1982



Unit pictured with EA Panel

"Pigeon Pair" companion to the new 500MHz DFM. Low distortion generator of sine, square and triangular waveforms. From below 20Hz to over 160kHz. Inbuilt 4 digit frequency counter in de-luxe Pac-Tec case. Only $85

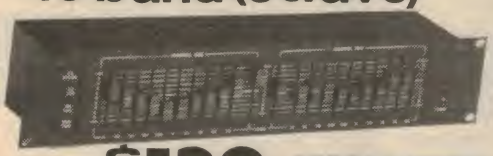
JAYCAR EXCLUSIVE – 1% 50ppm metal film resistors used for stability and it's still only $99!!!

Only $99

SPECIAL JAYCAR PANEL SUPPLIED

19" RACK–MOUNT GRAPHIC EQUALISERS

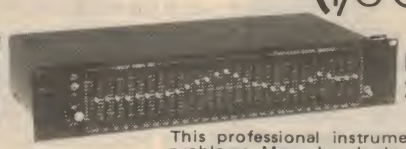
10 band (octave)



$139 STEREO MODEL 2010 MkII (A)

19" Rack Mount. Matches the ETI 5000 series components Makes a logical addition to your 5000AMP/Preamp combination. Based on the ETI 485 Graphic Equaliser but updated with state-of-the-art IC's. Incredible Performance.
Only $139 which includes the 19" rack cabinet.

(1/3 OCTAVE) 28 BAND



MONO MODEL 2801 MkII (A) **$225**

This professional instrument is used for total control of acoustic problems. Many hundreds of these are in use by live P.A. operators, Disco installations, recording studios and even the audiophile who demands the ultimate in control.
The kit uses state of the art I.C.'s for low noise, high slew rate and sharp band pass filters. Because it's a kit you save a fortune over built-up units which generally cost over three times the price of this unit.

NOW INCLUDES CANNON INPUT/OUTPUT CONNECTORS.

As used by Warren Cann of 'Ultravox

syntom

Original design from the UK magazine "Electronics and Music Maker" April 1981. Self-contained unit produces a variety of fixed and falling pitch effects. Trigger by tapping the unit itself or by striking a drum to which the unit is attached. The Jaycar "SYNTOM" comes complete with high quality pre-drilled moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.
FEATURES: Decay from less than 0.1 second to several seconds, pitch control, sweep control and volume on-off.

Only $36.50

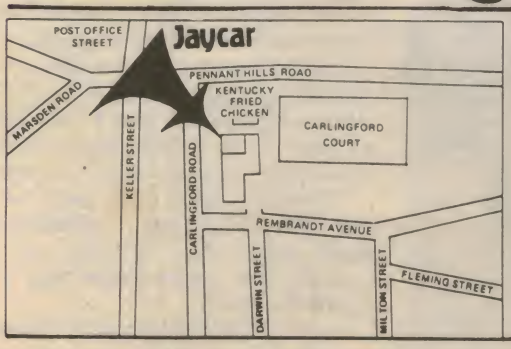
GOOD-BYE 3002

This 2x300W RMS P.A. Head is a classic road amp. Ruggedly constructed, 19" rack mount makes an ideal main P.A. or foldback unit. Great for Disco use as well.

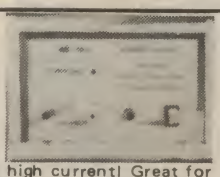
We are discontinuing this amp because it is becoming too expensive to make. The metalwork costs alone now account for well over 50% of the unit. Because of this we have reluctantly decided to discontinue the unit.
You can grab one now while they last for only $399

~~$489~~ **$399**

Send SAE for full spec. sheet.



ETI 160 POWER SUPPLY 13.8V @ 10A



Oodles of regulated high current! Great for powering your high power mobile or linear at home!! Can also charge up a car battery pretty smartly too!! The Jaycar kit comes with Beryllium Oxide washers to help get the heat out of the two MJ15004 series regulator transistors. Complete kit includes box.

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The time has come for computers to speak for themselves! Our speech synthesiser project can be used with any computer that has a Centronics type parallel interface and adds a versatile, easy to use voice — with an almost unlimited vocabulary.

by PETER VERNON

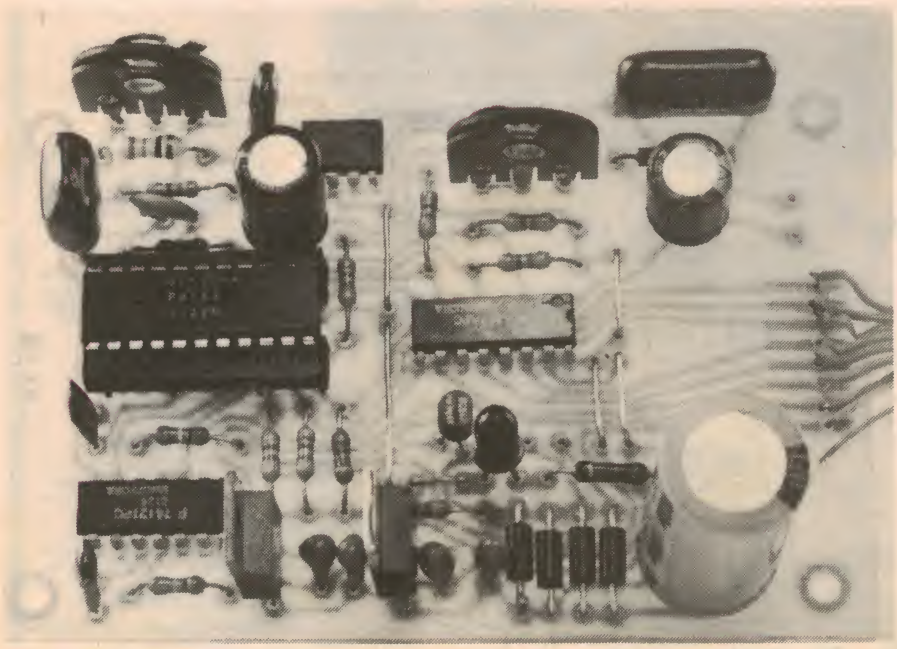
Talking computers are not new – systems with limited vocabularies have been available, at a price, since the 1960s. What is new is the low cost and versatility of single chip speech synthesisers.

Apart from the challenge to experimenters and the sheer fun of speaking computers, voice synthesis has some serious applications. Obviously, speaking computer terminals are useful for conveying information to a user who cannot sit with eyes glued to the screen. Speech can also provide computer facilities to the blind and visually handicapped, and there are a number of talking calculators available for this purpose.

Voice Input/Output also seems to be the coming thing for consumer items. Already announced in Japan are a television set which responds to voice commands, and a microwave oven that actually tells you "dinner is ready"!

What is lacking though, is a low cost set-up for the experimenter. Tandy's voice synthesiser for TRS-80 machines, and the Type 'N-Talk for the System-80 are available, but these devices cost over $500, and are designed for use with particular computers.

Both devices are based on chips from the Votrax division of the Federal Screw Works, a United States company which also manufactures the Votrax SC-01 single chip speech synthesiser.



The speech synthesiser can be connected to a standard Centronics port.

This project is based on the SC-01 chip, and can be connected to any computer which has a Centronics-compatible parallel output port. With our design you can have a computer-controlled speech synthesiser for around $100-$150, depending on what sort of case, loudspeaker and connectors you choose.

Since the Votrax chip produces individual sound units, or "phonemes" on command, and these can be strung together in any combination, our speech synthesiser can produce any word at all, unlike systems such as the National "Digitalker" which store whole words in ROM, and hence have a fixed and limited vocabulary.

Votrax SC-01

The 22-pin Votrax SC-01 chip contains a phoneme controller and a series of filters which form an electronic analog of the human vocal tract. The phoneme controller translates a six-bit phoneme code into a series of parameters for the vocal tract model, while two inflection bits control the pitch of the noise tone sources fed to the filters.

Overall, the output pitch of the phonemes is controlled by the frequency of the clock signal, set with an external resistor/capacitor combination. We did not make use of the two inflection inputs (pin 2 and 3 of the SC-01) as we have found that the automatic inflection provided by the chip itself is satisfactory.

A phoneme sound is produced when a six-bit phoneme code is placed on the control register input lines (P0 to P5) and latched by a pulse on the strobe (STB) input. Each phoneme sound has a duration of from 47 to 250ms, and variations in the clock frequency affect this duration.

The six-bit digital code gives 64 possible codes. There are 25 different consonant sounds ("c", "p" etc), 36 vowel sounds, two pause codes and a "stop synthesis" code.

In the English language, there are five vowels ("a", "e", "i", "o", "u"), so some of the 36 vowels of the SC-01 are the same

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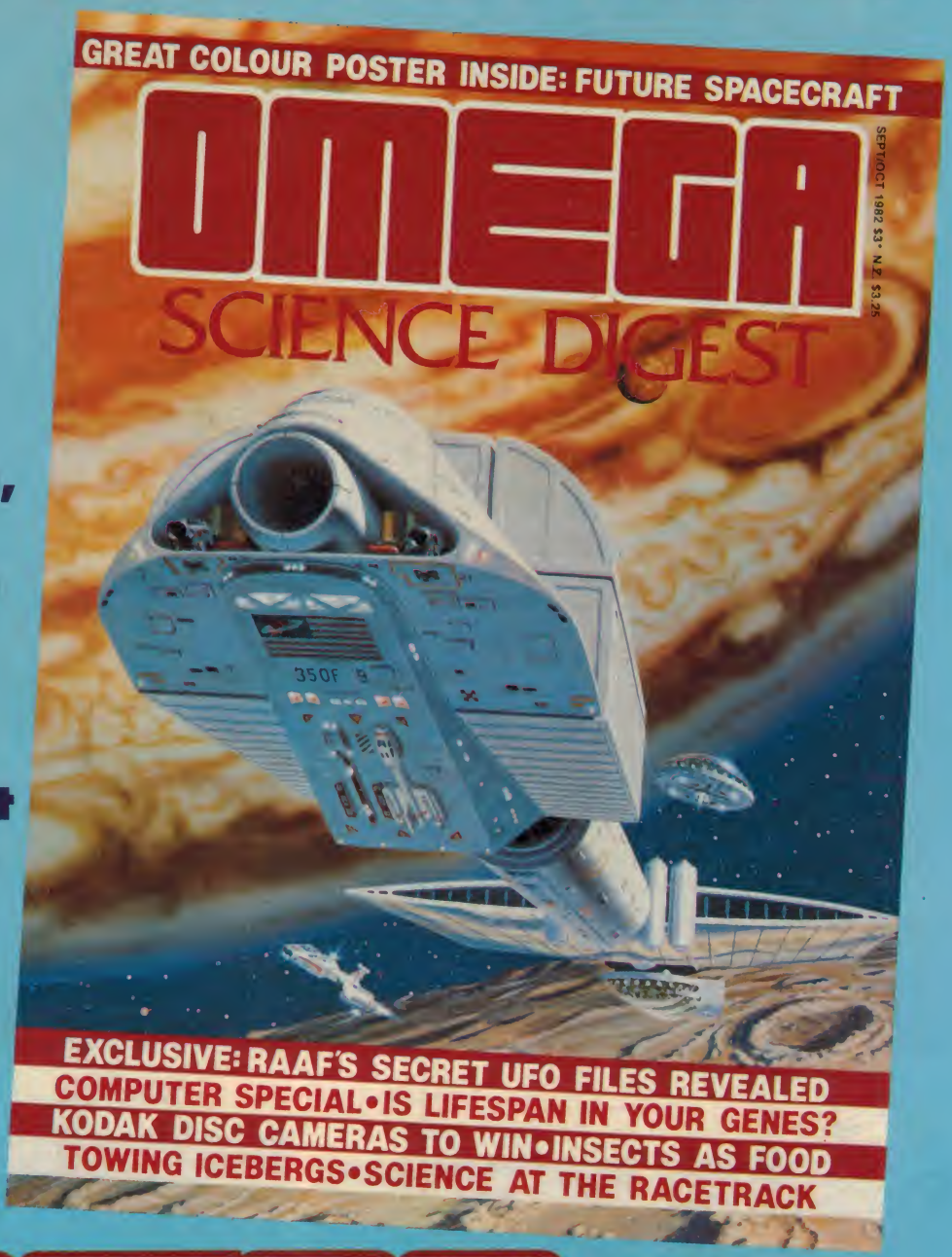

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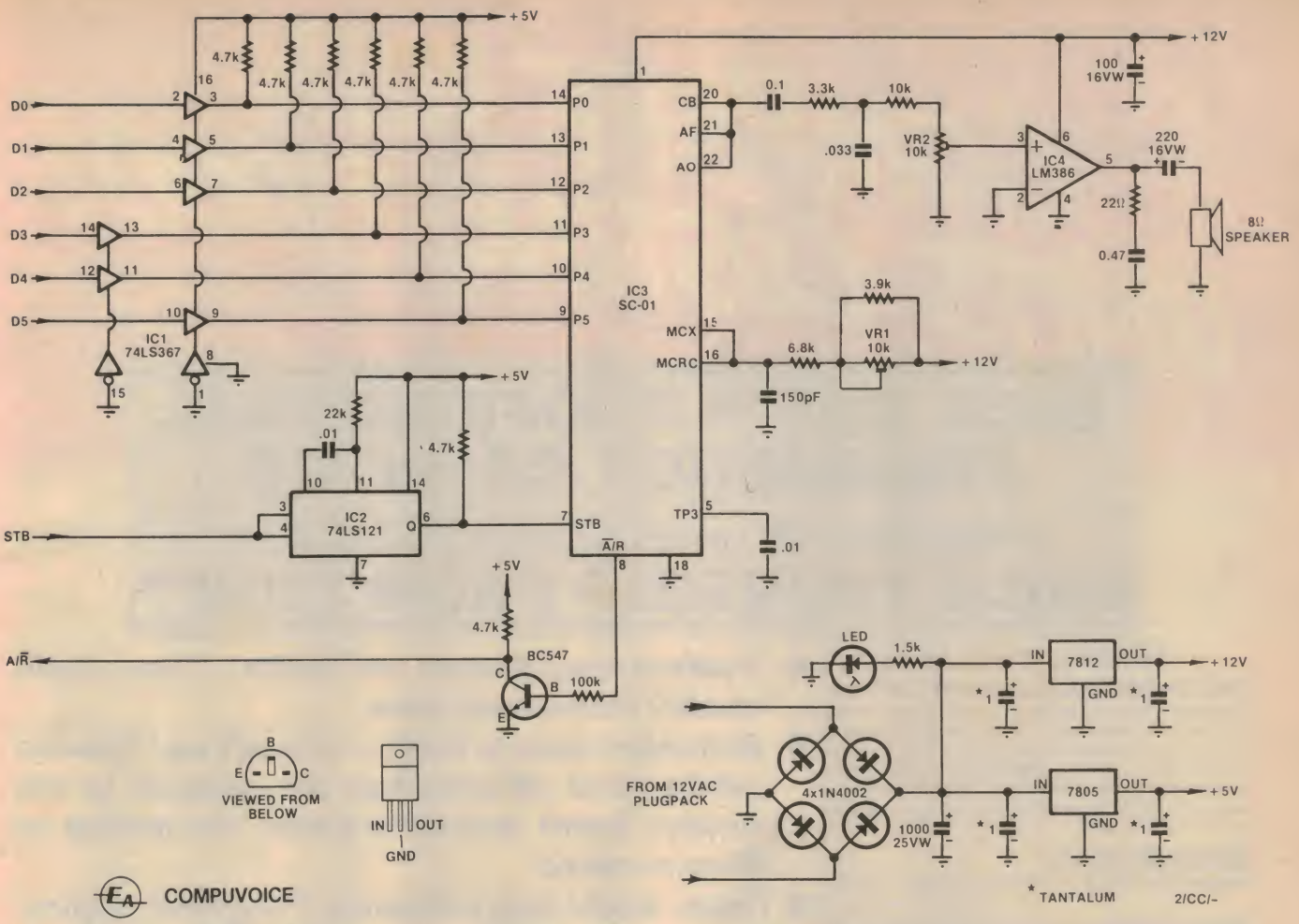

Fig. 1: the full circuit diagram is shown above. Note that inflection inputs of SC-01 are not used.

basic sound with differing durations. For example, while EH is the phoneme symbol for the "eh" sound in "ready", EH1, EH2 and EH3 are the same sound with progressively shorter durations. EH3 is the shortest, as in "jacket". Table 1 shows the various phoneme symbols, the sounds they make and the ASCII character for each phoneme.

By selecting the appropriate phonemes in the correct order, any word in the English language can be produced by the SC-01, plus words in many other languages. (Swahili is a bit beyond the SC-01 because it can't produce the nasal click sounds, but French and German should be quite feasible with careful programming.)

How it works

As shown in Fig. 1, a data buffer (IC1) drives the phoneme code inputs of the SC-01, with external pull-up resistors on the buffer outputs to ensure compatibility with the synthesiser chip. The data is latched on the rising edge of the positive-going strobe pulse on pin 7 of the SC-01, the STB input line.

The SC-01 requires some setup time before it can accept the strobe signal. The data on the phoneme input lines must be stable for at least 450ns before the rising edge of the strobe pulse and the logic level on the STB input must be low for approximately 100 microseconds (72 clock periods) before it goes high for the strobe pulse.

Many strobe pulses used with printer interfaces do not fulfil these requirements, which is the reason for the inclusion of IC2, a monostable which "stretches" the strobe pulse from the printer interface to around 100 microseconds before passing it to the SC-01.

The A/R output of the SC-01 is at logic 1 when the synthesiser is ready to accept data, and goes to a logic 0 while a phoneme is being produced. This line serves the same purpose as the BUSY signal produced by a printer.

The A/R line produces a CMOS compatible signal, swinging almost to the full supply voltage of the SC-01. This is not suitable for connection to the TTL circuitry of the typical printer port, so a transistor is used to translate this level to +5V. The transistor also inverts the A/R signal, so the final output is 1 when a phoneme is sounding and 0 when the synthesiser is ready to accept a new phoneme code. This corresponds with most printer drivers.

An external capacitor/resistor combination on pins 15 and 16 of the SC-01 set the frequency of the internal clock circuit of the speech synthesiser. The frequency of the clock (nominally 720kHz) affects the pitch of each individual sound and also the rate at which phonemes are sounded. By varying VR1 through its range, the speed of speech can be controlled, from "chipmunk style" to very slow.

The SC-01 has three audio outputs which can be configured to drive simple class-A or complementary class-B amplifier stages. In our version, these three outputs are connected together, passed through a simple RC filter and fed to an IC power stage, IC4. This is an LM386 which is capable of delivering up to 700 milliwatts into an 8Ω load. It has an internal network giving a fixed gain of 20. A Zobel network across the amplifier output consisting of a 22Ω resistor and 0.47μF capacitor helps ensure circuit stability.

A 12VAC plug pack adapter provides the power supplies for the project. The TTL circuits of course require 5V, while the CMOS Votrax chip and the integrated circuit amplifier require a supply voltage between 7V and 14V. We have chosen 12V.

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Resolution: 1Hz on 0-10MHz range; 10Hz on 0-50 MHz range, 100Hz on 10-500MHz range.
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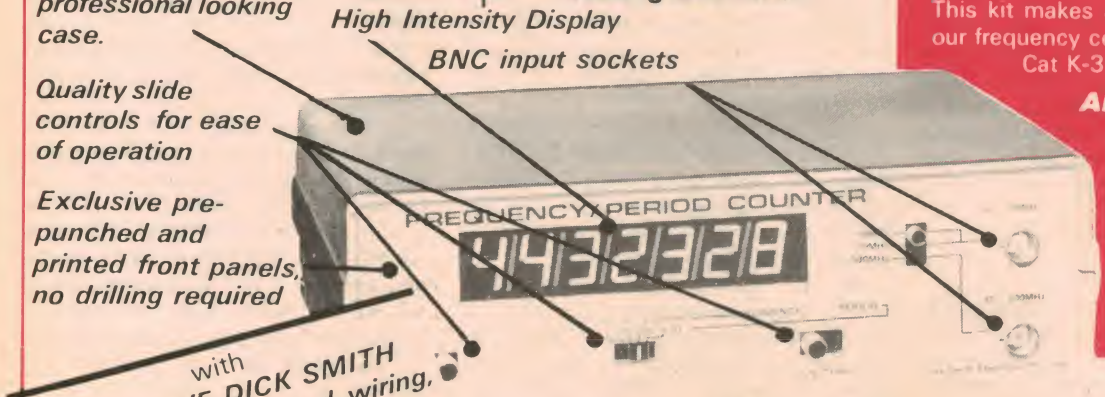

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Compuvoice speech synthesiser

We are presenting the project as a PCB only, leaving constructors to make their own decisions about a box for the synthesiser and loudspeaker.

Begin construction with the power supply section, taking care that the diodes, regulators and electrolytic capacitor are installed with the correct polarity, as shown in the component overlay diagram. We have included a LED in the +5V line as a "power on" indicator, and this too must be correctly oriented.

When this section is complete (not forgetting the bypass capacitors on the input and output of both regulators) connect the plugpack and check the voltages supplied by the regulators. If all is well, disconnect the plug pack and continue with construction of the speech synthesiser.

Install the resistors and capacitors as shown on the overlay diagram, again taking care that the electrolytic and tantalum capacitors are correctly oriented. The two 10kΩ trimpots can also be installed at this point.

As shown on the circuit diagram, VR1 controls the clock frequency of the Votrax chip, affecting the pitch and duration of the sounds produced. VR2 is the volume control, and may be replaced with a 10kΩ potentiometer mounted on the front of the case if you require an accessible volume control. Keep the wiring to the potentiometer as short as possible if you elect to do this.

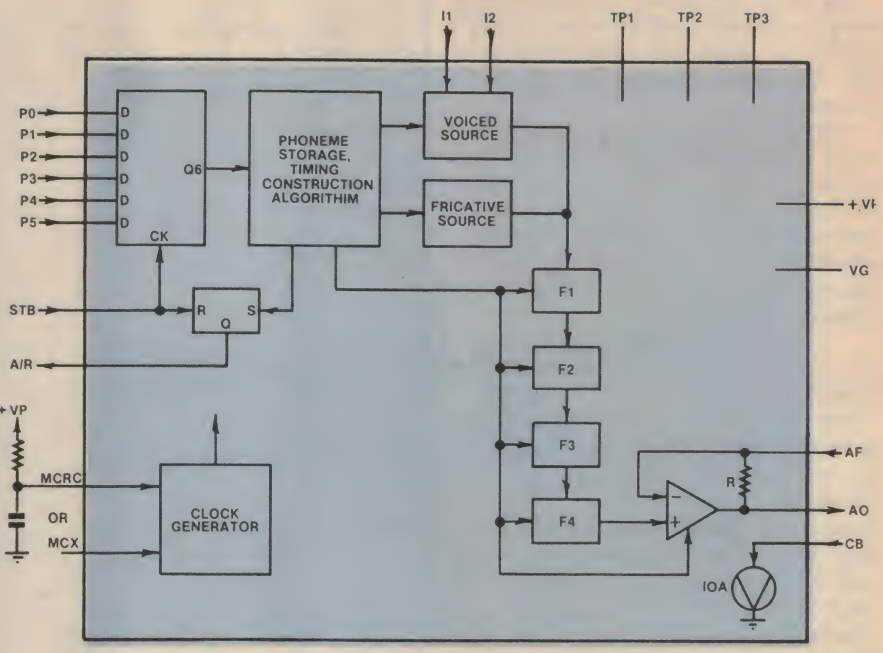
We found in practice that once the trimpot is adjusted for a comfortable volume level further adjustment was unnecessary, so we did not mount an external volume control.

There is one transistor to be installed, and this must, of course, be mounted the correct way round. The circuit diagram shows the lead configuration.

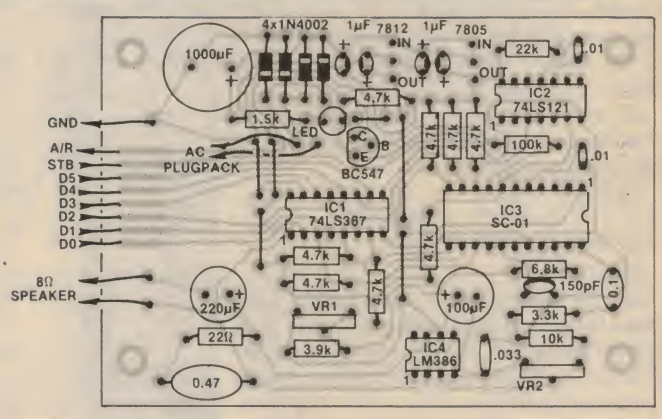
At this stage the integrated circuits can be installed – except for the SC-01. We elected to use a socket for the Votrax chip but had difficulty finding a source of 22-pin IC sockets. As an alternative, we obtained a strip of single-in-line wirewrap sockets and cut two lengths to suit. Molex pins could also be used.

Install IC1, IC2 and IC4, and whatever socket you decide to use for IC3 (the SC-01). Before proceeding connect the plugpack and power up again. Check for 12V on pin 1 of the socket and ground on pin 18. Turn off the power.

The Votrax chip is a CMOS device, and is sensitive and very expensive as you will be aware if you purchase this kit. Do not remove it from its conductive foam or foil package until you are ready to install it in its socket. Take the usual precautions against static discharge (ground yourself by touching an earthed appliance before handling the SC-01) and try not to touch the pins of the chip as you install it.



Internally the SC-01 consists of a phoneme storage unit and a series of digital filters, simulating the human vocal tract.



The component overlay diagram is shown at right.

Our synthesiser is connected to the computer by a ribbon cable terminated in a 34-way double-sided edge connector. There are six data input lines to the board, a strobe signal and a BUSY signal from the synthesiser to the computer, in addition to the ground connector. The pin connections we have shown in Fig. 3 suit the standard Centronics parallel format as used by most computer systems that incorporate a parallel printer port, including the System-80 expansion interface, the Super-80 printer interface and our TRS-80 parallel interface project (September 1981).

PIN		FUNCTION
1		STROBE
3	DATA	D0
5	"	D1
7	"	D2
9	"	D3
11	"	D4
13	"	D5
15	"	D6
17	"	D7
19		not used
21		BUSY (from synthesiser)
23-33		not used
2-24		GROUND
26-34		not used

Centronics edge connector pin-outs

Programming in phonemes

As shown in Table 1, each phoneme that the SC-01 can produce may be represented in three ways. Column one of the table shows the six-bit hexadecimal code for each basic sound, while column two shows the Votrax "phoneme symbol".

Column three shows the particular ASCII character whose six lowest bits correspond to the hexadecimal phoneme code. For instance, the hexadecimal 01 code corresponds to the phoneme code "EH2" and the ASCII code for "A" (ASCII "A" is 41 in hexadecimal – the six lowest bits give us 01, the hex phoneme code). Column four of the table gives one example of a word in

which each corresponding phoneme (bracketed) occurs.

The most convenient way of programming the speech synthesiser is to send it the ASCII characters corresponding to the phoneme codes we want to produce.

"LPRINT", a statement contained in most versions of Basic, will transmit to a printer anything between quotation marks, except for the quotation marks themselves and a few control characters, whether it is a valid word or not. This means that driving the speech synthesiser is as simple as writing;

```
LPRINT "]B#X#57"; "?";
```

If you try this the synthesiser will say "hello".

The semi-colons in this statement are quite important. The SC-01 will continue to produce the sound of the last phoneme code it receives until a new code is sent. Basic normally sends a Carriage Return character after each LPRINT statement, and a carriage return (OD in hex) is the ASCII code for the "N" phoneme. The first semi-colon suppresses the transmission of a carriage return, while the "?" represents the STOP code which silences the synthesiser. Don't forget the final semi-colon.

A test routine to make phoneme sounds or complete words can use the following program;

```
10 INPUT A1$
20 IF A1$="END" THEN END
30 LPRINT A1$; "?";
40 GOTO 10
```

Line 20 allows us to exit the test program by typing END. Otherwise the program continues to loop, asking for a sequence of ASCII codes and sending them to the synthesiser.

Words can also be constructed by selecting the phoneme codes which correspond to each syllable of the desired word and constructing a string of the equivalent ASCII codes for transmission to the speech synthesiser.

Several lists of words and their corresponding phoneme codes have been published, such as in Byte magazine for June 1981. Unfortunately lack of space prevents us from publishing our own list this month. Look for it in the next issue

Phonemes can be put together to produce almost any word. But the problem then is to translate the phoneme code to ASCII. We have solved that problem by using the computer.

We have produced a program (listing 1). This takes a sequence of phoneme codes, looks up the corresponding ASCII code, and then sends it to the speech synthesiser. It was developed on a Super-80 fitted with a printer interface board and driven by the parallel printer program published in EA, May 1982.

Users of other computers will notice a couple of differences in the string hand-

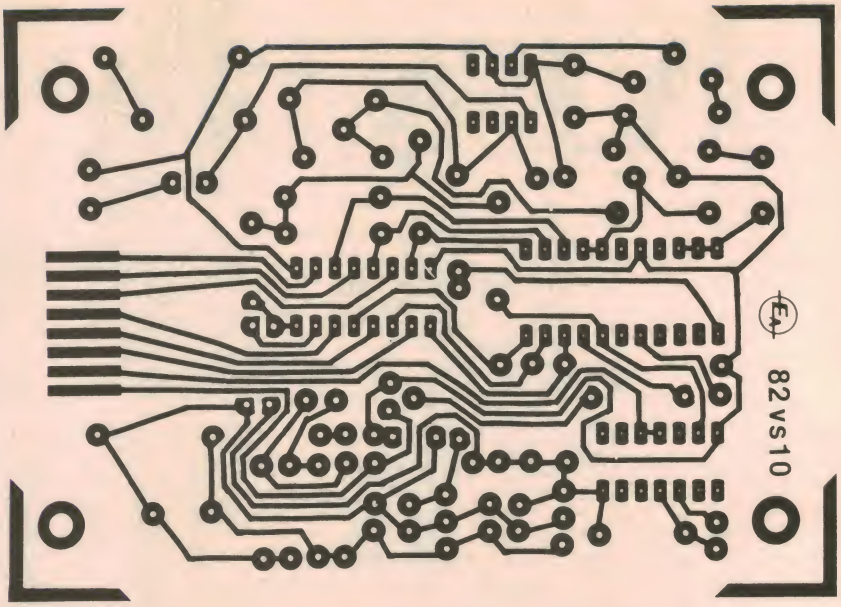
Table 1: Votrax phoneme codes

Hex Phoneme Code	Phoneme Symbol	ASCII Character	As in Example
ØØ	EH3	@	jack(e)t
Ø1	EH2	A	(e)nlist
Ø2	EH1	B	h(ea)vy
Ø3	PAO	C	no sound
Ø4	DT	D	bu(tt)er
Ø5	A2	E	m(a)ke
Ø6	A1	F	pa(i)l
Ø7	ZH	G	plea(s)ure
Ø8	AH2	H	h(o)nest
Ø9	I3	I	b(i)t
ØA	I2	J	(i)n
ØB	I1	K	(i)t
ØC	M	L	(m)at
ØD	N	M	su(n)
ØE	B	N	(b)ag
ØF	V	O	(v)an
1Ø	CH	P	(ch)ip
11	SH	Q	(sh)op
12	Z	R	(z)oo
13	AW1	S	l(aw)
14	NG	T	thi(ng)
15	AH1	U	f(a)ther
16	OO1	V	l(oo)king
17	OO	W	b(oo)k
18	L	X	(l)and
19	K	Y	tric(k)
1A	J	Z	(j)u(dg)e
1B	H	(left square bracket)	(h)ello
1C	G	(slash)	(g)et
1D	F	(right square bracket)	(f)ast
1E	D	(up arrow)	pai(d)
1F	S	(back arrow)	pa(ss)
2Ø	A	(space)	t(a)me
21	AY	!	j(a)de
22	Y1	"	(y)ard
23	UH3	#	miss(i)on
24	AH	$	m(o)p
25	P	%	(p)ast
26	O	&	c(o)ld
27	I	'	p(i)n
28	U	(	m(o)ve
29	Y	)	an(y)
2A	T	*	(t)ap
2B	R	+	(r)ed
2C	E	,	m(ee)t
2D	W	-	(w)in
2E	AE	.	d(a)d
2F	AE1	/	(a)fter
3Ø	AW2	Ø	s(a)lty
31	UH2	1	(a)bout
32	UH1	2	(u)ncle
33	UH	3	c(u)p
34	O2	4	b(o)ld
35	O1	5	ab(oa)rd
36	IU	6	y(ou)
37	U1	7	J(u)ne
38	THV	8	(th)e
39	TH	9	(th)in
3A	ER	:	b(ir)d
3B	EH	;	r(ea)dy
3C	E1	<	b(e)
3D	AW	=	c(a)ll
3E	PA1	>	pause
3F	STOP	?	no sound

Compuvoice: Program listing 1

```
00010 CLS
00100 DIM B0(50),B(50)
00110 PRINT "ENTER PHONEME CODES"
00120 PRINT "SEPARATED BY SPACES."
00130 PRINT "PRESS RETURN AT END."
00140 PRINT"TO QUIT PRESS RETURN"
00150 PRINT "WITH NO ENTRY"
00160 C=0:PRINT
00170 INPUT A0$
00180 A0$=A0$+" "
00200 IF LEN(A0$)=0 THEN GOTO 400
00210 C=C+1
00220 FOR I=1 TO LEN(A0$)
00230 IF A0$(;I,I)<>" " THEN NEXT I
00240 B0$(C)=A0$(;1,I-1)
00250 A0$=A0$(;I+1)
00260 GOTO 200
00400 IF C=0 THEN GOTO 700
00410 FOR A=1 TO C
00420 READ A1$,D
00430 IF A1$="OUT" THEN GOTO 600
00440 IF A1$<>B0$(A) THEN GOTO 420
00450 B(A)=D:RESTORE:NEXT A
00460 PRINT"IN ASCII CODES THAT'S"
00470 FOR A=1 TO C
00480 E=B(A)
00490 LPRINT[A1 E];
00500 PRINT [A1 E];
00510 NEXT A
00520 LPRINT"?";
00530 GOTO 160
00600 PRINT "ERROR - NO ";B0$(A);" CODE":END
00700 PRINT "NO ENTRY?":END
01000 DATA "EH3",64,"EH2",65
01010 DATA "EH1",66,"PA0",67
01020 DATA "DT",68,"A2",69
01030 DATA "A1",70,"ZH",71
01040 DATA "AH2",72,"I3",73
01050 DATA "I2",74,"I1",75
01060 DATA "M",76,"N",77
01070 DATA "B",78,"V",79
01080 DATA "CH",80,"SH",81
01090 DATA "Z",82,"AW1",83
01100 DATA "NG",84,"AH1",85
01110 DATA "OO1",86,"OO",87
01120 DATA "L",88,"K",89
01130 DATA "J",90,"H",91
01140 DATA "G",92,"F",93
01150 DATA "D",94,"S",95
01160 DATA "A",32,"AY",33
01170 DATA "Y1",34,"UH3",35
01180 DATA "AH",36,"P",37
01190 DATA "O",38,"I",39
01200 DATA "U",40,"Y",41
01210 DATA "T",42,"R",43
01220 DATA "E",44,"W",45
01230 DATA "AE",46,"AE1",47
01240 DATA "AW2",48,"UH2",49
01250 DATA "UH1",50,"UH",51
01260 DATA "O2",52,"O1",53
01270 DATA "IU",54,"U1",55
01280 DATA "THV",56,"TH",57
01290 DATA "ER",58,"EH",59
01300 DATA "E1",60,"AW",61
01310 DATA "PA1",62,"STOP",63
01320 DATA "OUT",64
```

Compuvoice speech synthesiser



The full size printed circuit board pattern in shown above.

ling statements of Super-80 Basic, and will need to make the changes which follow.

First of all, Super-80 Basic uses the same arrays for numbers and strings (alphabetic characters). In line 100 of listing 1, B0(50) is used to dimension a string array – so change this to DIM B0$(50) for use with other versions of Basic. You may also have to insert a CLEAR 100 statement to clear sufficient space for the string arrays used in the program. All string variables in Super-80 Basic consist of a letter followed by a number, which may not be required in other Basic versions.

In line 230 of the program, A0$(;I,I) is equivalent to MID$(A0;$I,1). It returns the character in position I of the string. In line 240, A0$(;1,I-1) is equivalent to LEFT $(A0$,I-1), and returns the first I characters of the string, less one. Line 250 of the listing has A0$=A0$(;I+1) and is replaced by A0$= MID$(A0$,I+1, 100). The "100" is arbitrary – it just makes sure that we get all the characters from position I+1 to the end of the string.

Finally, LPRINT [A1 E] in Super-80 Basic is equivalent to LPRINT CHR$(E) in other versions of Basic.

The program in listing 1 displays the ASCII character correspondening to each phoneme code as it is spoken. By noting down these ASCII characters and placing them in DATA statements any sort of vocabulary can be created.

COST ESTIMATE: $90. This does not include the cost of a loudspeaker, plugpack supply or case.

PARTS LIST

1 Printed circuit board, code 82VS10, 105mm x 71mm
1 loudspeaker
1 45cm length of 9-way ribbon cable
1 34-way printed circuit board edge connector to suit Centronics type parallel interface
1 12V AC plug pack
1 22-pin socket (see text)

SEMICONDUCTORS
1 74LS367 hex bus driver
1 74LS121 monostable multivibrator
1 SC-01-A speech synthesiser
1 LM386 audio amplifier
1 BC547 NPN transistor
1 7805 +5V voltage regulator
1 7812 +12V voltage regulator
4 IN4002 diodes
1 light emitting diode

CAPACITORS
1 1000µF/25VW electrolytic
1 220µF/16VW electrolytic
1 100µF/25VW electrolytic
4 1µF tantalum
1 0.47µF greencap
1 0.1µF greencap
1 .033µF greencap
2 .01µF greencap
1 150pF ceramic

RESISTORS (¼W, 5% unless stated)
1 x 100kΩ, 1 x 22kΩ, 1 x 10kΩ, 1 x 6.8kΩ, 8 x 4.7kΩ, 1 x 3.9kΩ, 1 x 3.3kΩ, 1 x 1.5Ω, 1 x 22Ω, 2 x 10kΩ large vertical trimpots.

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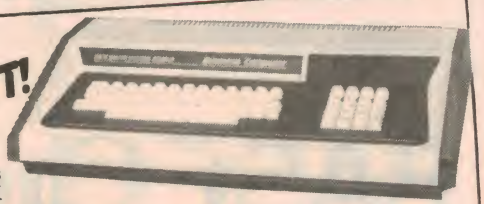

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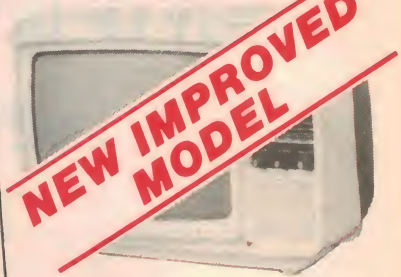

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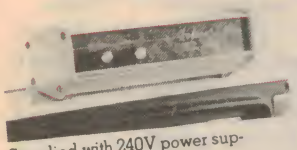

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DICK SMITH Electronics

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DSE/A358/LM

Novel circuit provides instant turn-on

Electronic starter for fluorescent lamps

Do your fluorescent lights go blink, blink, blinkety-blink when you switch them on? This substitute electronic starter solves that problem and gives a smooth, rapid start every time you switch on. All the parts are housed in a standard starter case so the light wiring does not have to be modified.

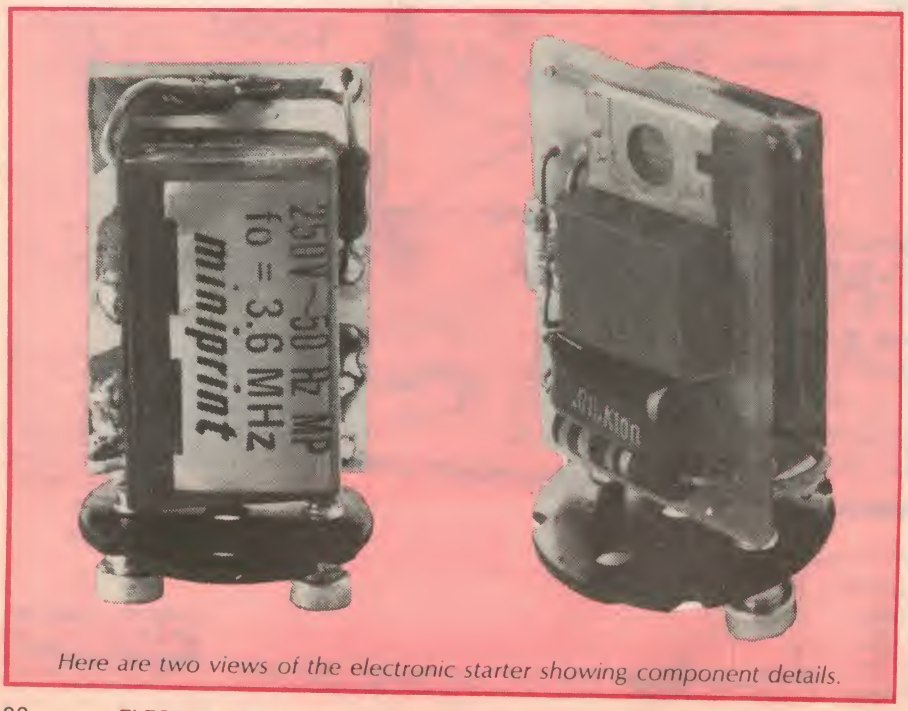
by LEO SIMPSON

Are you one of those poor unfortunates who has to rise in the dead of the night for what the Americans euphemistically call a "comfort break"? And do you find the blinkety-blink flashing of a fluorescent light switched on in pitch dark a trifle off-putting, if not to say, blinding? As luck would have it, this problem is made worse when temperatures are low, which adds to the misery.

This new electronic starter not only solves the problem of random flashing and temporary blindness when fluorescent lights are switched on but also reduces RF interference. It may also contribute to extended tube life. With that list of advantages we realise that you are just rearing to know how it works, so let us first discuss how a fluorescent light works and starts normally.

There are a surprisingly large number of fluorescent light circuits including instant start, rapid start, lead-lag ballast and so on but the configuration most commonly found in domestic and commercial lighting installations is still the starter-preheat system shown in Fig. 1.

While this circuit looks fairly simple, it is in fact quite complicated in operation, as are most types of fluorescent light circuit. However, we will attempt to give as straightforward a description as possible. Essentially, the circuit has two modes of operation, start and run. In the start mode, the starter is involved (no, we're not putting you on) and in the run mode, the starter is effectively out of circuit.



Here are two views of the electronic starter showing component details.

Everyone is familiar with the ubiquitous fluorescent light tube but few people are aware of their make-up. Basically, the glass tube has a filament heater at each end and contains a minute quantity of mercury and a mixture of inert or noble gases at very low pressure.

The filament heaters are usually made of triple-coiled tungsten wire which is coated with an emissive material such as barium or strontium oxide. In the start mode, current is passed through the two filaments to raise them to red heat. At this temperature they emit electrons freely (thermionic emission) which rapidly disperse in the tube so that an electric discharge can occur through the inert gas when a high voltage is applied between the two filament electrodes.

The electric discharge first occurs through the inert gas which rapidly heats up and thereby vaporises the small quantity of mercury. The mercury atoms are then excited by the arc discharge and they release energy which is mainly in the form of ultraviolet radiation at a wavelength of 253.7 nanometres.

This ultraviolet radiation then impinges onto the white phosphor coating on the inside of the tube which then "fluoresces" to emit visible light. About 20% of the ultraviolet radiation is transformed to visible light while the rest is liberated as heat.

We can now return to the circuit of Fig. 1. When the electric discharge is established in the fluorescent tube, it has a low and essentially negative resistance. Effectively, this means that once the arc is started the current will rapidly increase until the tube overheats and burns out. To prevent this, a "ballast" is connected in series with the tube. The ballast is an iron-cored inductor which "saturates" at a predetermined current level and

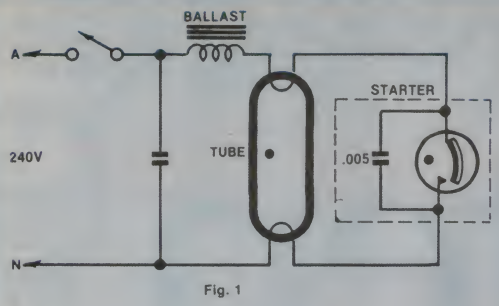


Fig. 1

Fig 1: Common fluorescent starter circuit.

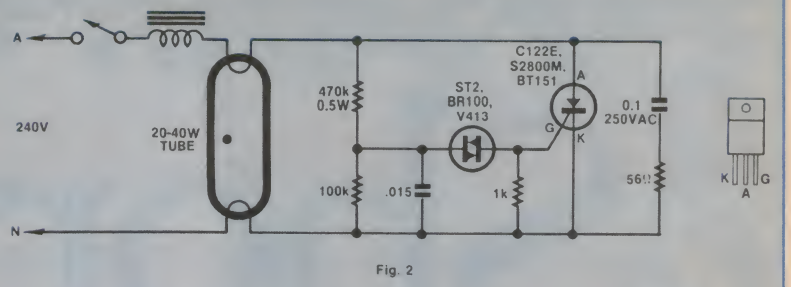


Fig. 2

Fig 2: Circuit diagram for our electronic "instant" starter.

thereby limits the current through the tube to a safe level.

So that is how the ballast functions in the "run" mode. In normal operation, the tube actually strikes and extinguishes during every mains half-cycle so that it actually flashes at a rate of 100Hz.

Power factor correction

The purpose of the capacitor across the mains input is to correct the low power factor of the ballast. In other words, the capacitor compensates for the lagging current of the ballast and makes the overall loading of the circuit appear more resistive. These power factor correction capacitors are not normally present in fluorescent light fittings in home installations but are generally required for those used in commercial and industrial situations.

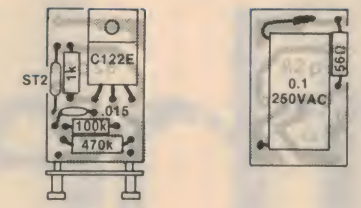
As well as limiting the current through the tube to a safe value during the "run" mode, the ballast also plays a crucial part in the "start" mode. This mode occurs as follows:

When power is first applied, a small current flows via the ballast, tube filaments and starter bulb which is filled with argon (or some other inert gas). Within a few milliseconds the ionising and resultant heating of this gas causes a set of bimetallic contacts in the starter to close and a relatively heavy current then flows through the tube filaments and ballast.

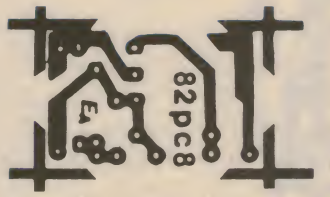
While the tube filaments heat up and begin emitting electrons, the starter bulb then cools again and the bimetallic contacts open to interrupt the filament current. The ballast does not like this and generates a large peak voltage which then fires the fluorescent tube, if all goes well.

In practice, though, the starter usually needs more than one attempt to fire the fluorescent tube. For example, the mains voltage may be a little low, the ambient temperature may also be low and the starter may interrupt the filament current just when it was low or passing through zero, in which case, little or no peak voltage would be generated by the ballast.

Typically then, the starter needs several "strikes" before the tube fires reliably. This is why fluorescent lights characteristically flash several times, in that annoying fashion we all know so well, when they are first turned on. And it also explains why the light generally fires straight away if you switch it off and then on again, after a period of operation.



Component overlays for both sides of the PC board.



Shown above is the full-size pattern for the PC board.

Note that the circuit of Fig. 1 shows a capacitor internally connected across the starter. The capacitor is usually a ceramic or Mylar dielectric type of about .005μF and is included to suppress RF interference which occurs at the moment of contact opening. The capacitor also provides some suppression of the RF interference produced by the electric discharge in the fluorescent tube itself.

Apart from this secondary suppression of RF interference by the starter capacitor, the starter plays no further part in the circuit operation once the tube has fully fired.

Flashing is not good

Not only does the initial flashing of fluorescent tubes annoy nocturnal humans but it may also seriously degrade tube life, due to excessive cycling of the filaments. To explain, the usual reason for eventual tube failure is that the filament emissive material becomes exhausted or the filament goes open circuit. If a tube is run continuously (ie, never turned off) its life will be almost twice that for a tube which is run with a cycle of three hours per start.

The answer to this problem is not to run the tubes continuously but to replace the starters more often or at least, replace the starter when the tube is replaced. Inevitably, though, the starter will noticeably deteriorate long before the tube approaches the end of its life. So this is where our electronic starter comes in. It will not deteriorate, it will give a reliable start every time and should give a longer tube life (although we have no data to support this theory at the time of writing).

Offsetting all the advantages of the electronic starter is its higher price. At around $5 it is a lot dearer than a conventional starter. We would not advocate replacing every starter in your home with this new device but there are probably one or two lights, say in your kitchen or bathroom, with which you will gain a worthwhile benefit.

Fig. 2 shows a fluorescent light fitting with the electronic starter in place of the conventional type. Essentially, the electronic starter is a silicon controlled rectifier (SCR) which feeds half-wave rectified AC to the filaments, via the ballast.

As the filament current drops to zero, at the end of every alternate half-cycle, the SCR turns off and the ballast generates a high voltage peak which then fires the tube. In effect then, the electronic starter gives the fluorescent tube a stream of repeated "strikes" until the tube fires sufficiently well to sustain conduction and give full illumination.

In practice, the tube comes on immediately the power is applied but at a relatively low level of brightness. Then, after one or two seconds it comes up to full brightness without flicker or any other drama. At the same time, the ballast makes a louder than normal buzzing noise during the brief turn-on period and thereafter makes no more noise than is normal.

We estimate the current cost of parts for this project to be approximately

$5

This includes sales tax.

The method of triggering the SCR is as follows: Mains voltage is applied via the ballast and tube filaments to a voltage divider network consisting of a 470kΩ and a 100kΩ resistor, to charge a .015μF capacitor. When the voltage across the capacitor rises to about 30V, the ST2 or equivalent Diac (a four-layer semiconductor) device breaks down and dumps the capacitor's charge into the SCR gate. This fires the SCR which then continues to conduct until the ballast current drops to almost zero at the end of the mains half-cycle.

The resulting voltage peak generated by the ballast is damped by the RC network across the SCR. This has the desirable effect of preventing damage to the SCR (by limiting the peak voltage) and also lengthening the time for which high voltage is applied to the tube so that a "strike" can occur.

Looking at it another way, the 0.1μF capacitor could be regarded as providing a series resonant network, in conjunction with the inductance of the ballast. This resonance is then excited by the voltage spike, generated by the back-EMF action of the ballast, and is damped by the 56Ω resistor plus the series resistance of the ballast itself.

The 1kΩ resistor connected between gate and cathode of the SCR prevents any likelihood of spurious triggering of the SCR when the tube is in the "run" mode. Note that once the tube is fired and running, the voltage across the electronic starter is low enough at about 100VRMS to prevent the starter from playing any further part in circuit operation, as with a conventional starter.

There is, however, a further bonus provided by the electronic starter in the form of the 0.1μF snubber capacitor. This has the effect of improved suppression of RF interference from the fluorescent tube. The electronic starter also produces much less "hash" at initial turn-on than a conventional starter so it all adds up to a much "quieter" fluorescent light, in the RFI sense.

We should point out that this circuit has already appeared in the June, 1982, issue of "Elektor" and may or may not be subject to a patent application in this country.

Construction

While the foregoing circuit description may have been fairly long and detailed, the construction of the electronic starter is quite easy and straightforward. In fact most hobbyists will probably have the job finished inside 10 minutes. That does not allow for soldering iron warm-up time.

As shown in the photographs, the starter circuitry is mounted on a small PC board, coded 82pc8 and measuring all of 19 x 29mm. Huge, isn't it! When the components are assembled, onto both sides of the board, the whole assembly is then shoe-horned into a conventional starter case.

Start construction by cannibalising a conventional starter. You need to remove the starter innards without damaging the circular lid which carries the two connector pins. Clip off the starter lamp and capacitor but leave the leads long enough, say about 5mm or so, so that they can be soldered to the PC board assembly.

For obvious reasons, you should not use a starter with a metal case.

Six components are mounted on the component side of the board, while two are mounted on the copper pattern side. Mount the small components first on the component side. Note that the Diac is a non-polarised component so it can be installed either way around.

Don't use an ST4!

It is most important that you use a Diac in this circuit and not the GE asymmetrical trigger device, the ST4. Make sure you are not fobbed off with this device, as seems to be common practice amongst uninformed counter staff. **The ST4 will not work.** There, you have been warned. We obtained BR100 Diacs from Jaycar but parts suppliers should have no problems laying in any one of the Diac types we have listed.

The SCR should be rated at a minimum of 500V and any one of the types listed will do nicely. Bend the three leads close to the SCR body before installing. Take care when doing this. Use a pair of long nose pliers to avoid undue strain on the case/lead join.

Now install the capacitor and resistor on the copper side of the board, as shown in the photographs and wiring diagram. The capacitor must be rated at 250VAC, as specified.

Finally, solder the board to the starter lid terminals. Then carefully check all connections visually. You could also use a multimeter, switched to the "ohms" ranges, to check the circuit components for continuity. The Diac should read open circuit and the SCR should be 570kΩ between anode and cathode (this is the value of the resistor string).

Now carefully slide the whole assembly into the starter case. This is a squeeze but it will fit. You are now ready to test the unit.

We have tested several prototypes of the starter on 20W, 40W and 65W lamp fittings but we are not certain whether the circuit is really suitable for 65W fittings. To be on the safe side we recommend that you try the unit on a 20W or 40W fitting. Just remove the existing starter, carefully install the electronic one and turn it on. You should be greeted by a smooth and fuss-free start. If not, the most likely fault is a dud SCR.

If the tube is old and will not fire with the electronic starter, do not leave it switched on, otherwise the ballast will burn out.

We should make a special note about the use of this starter in a dual 20W fitting which use two starters and one ballast. In some fittings, the electronic starter will not work, depending on the characteristics of the ballast and the polarity of the two starters. In view of this uncertainty, we do not recommend that the starter be used in these fittings, as well as the 65W fittings mentioned earlier.

PARTS LIST

1 fluorescent starter (to be cannibalised)
1 PC board, 19 x 29mm, code 82pc8
1 C122E, BT151 or S2800M 500V SCR
1 ST2, BR100 or V413 Diac
1 0.1μF/250VAC metallised dielectric capacitor
1 .015μF metallised polyester capacitor (greencap)
1 470kΩ/½W resistor
1 100kΩ/¼W resistor
1 1kΩ/¼W resistor
1 56Ω/¼W resistor

The Serviceman

Contributions month: fuses, focus and frustration

It's contributors' month this month, mainly because the response to the request panel in the previous month's notes has been quite surprising. In fact there is still some backlog, but this batch has helped reduce it. At the same time, other peoples' stories help broaden one's outlook and provide an insight into how they cope with the unusual.

The first contribution comes from J.E. of Bull Creek, WA. (I wonder what the local wags call it!) Anyway, it is one of a couple that J.E. has submitted, but I will hold the other one over this time, to give the rest of the mob a fair go. J.E. writes as follows.

The beginning of this story is not unfamiliar. The family monochrome TV set had failed completely – no picture and no sound – and had been replaced with a colour set. Then someone had suggested that it should be possible to repair the monochrome set – and had even suggested that it should not cost more than $15! Would I have a look at it?

With the exception of portable models, monochrome TV receivers are seldom worth repairing, especially if they are relics of the valve era. I was assured that this was a portable set, and the owner offered to deliver and collect it. The fact that it had failed completely suggested that it would be either easily fixed or obviously beyond economic repair.

NO VALVE HEATERS

When the set was delivered it turned out to be a 10 year old 58cm (23in) valve model. Its only pretension to portability was that it had an inbuilt antenna and was on castors!

When it was tried it was found that not even the heaters glowed. The mains fuse was intact, but a heater fuse, which consisted of just over 25mm of about 8A tinned copper wire on a tag strip, had blown; not violently, but just melted and parted.

This fuse was replaced with 10A fuse wire and the set seemed to work satisfactorily, but the question was, why did the fuse blow? The heater wiring was checked visually, and also at 500V DC, but no fault showed up.

During the removal of the chassis to make these heater checks it was found that the manufacturer had supplied a spare mains fuse and a length of fuse wire for the heaters. Although the latter looked appreciably lighter than the original, it was used to replace the 10A fuse wire, which had had to be removed, along with the valves, for testing the heater wiring insulation.

When the chassis was replaced and turned on the new heater fuse came up to a lovely red glow, and then failed. Had the fault returned or was the fuse too light? Reference to the manufacturer's diagram showed that the fuse wire should be .014in diameter, whereas the spare fuse wire was only .010in diameter, and that originally fitted was .013in diameter. Which was correct?

The total current drawn by the picture tube and valve heaters was about 7A, and .010 tinned copper wire has a rated fusing current of about 10A and a safe working current of about 7A – so why should it fail?

"I tried to claim for ceiling damage but the assessor wouldn't hear of it!"

Valve heater resistance, when cold, is about one fifth of that when hot. At the instant of switch-on, therefore, the current could be in excess of 35A. Because of its thermal inertia a fuse will withstand some overload, but its survival would depend on the amount of overload and its duration.

The heater fuse was therefore replaced with .014 tinned copper wire, as specified by the manufacturer, which has a rated safe working current of about 10A and which showed no signs of overheating when the set was turned on.

Why did the original fuse fail? I can only assume that it was just a little too light, causing it to overheat and oxidise a little each time the set was turned on. Eventually, it deteriorated to the point where it failed completely.

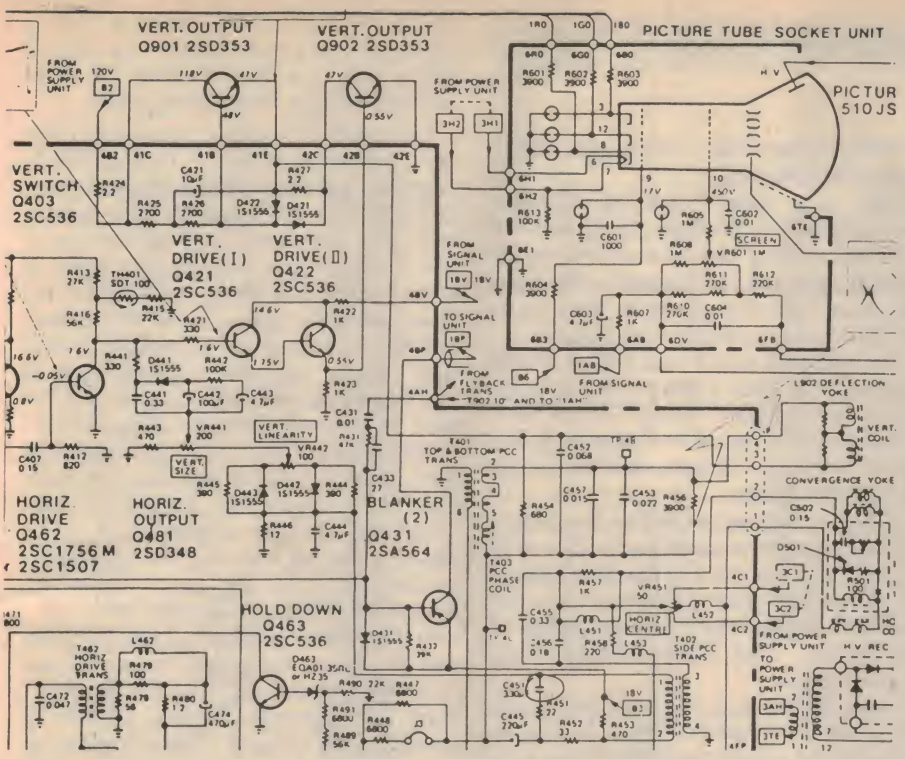
Well, thank you J.E., and I think your summary of the failure is pretty well spot on. The only point I could add is that fuses which are repeatedly overheated and cooled can also suffer from metal fatigue, but whether that was a factor in this case I wouldn't like to say. If it was, it was probably only minor.

In broader terms though, it seems surprising that the set was, apparently, originally written off for such a trivial fault. I can only assume that the owner was secretly hankering for a colour set and chose to regard the drastic symptoms, ie, total failure, as indicative of a catastrophic fault, and therefore ease his conscience in regard to the cost of the new set.

FRUSTRATION PLUS

The next story comes from Mr G.W. of Clarence Park, SA, and could probably be best titled, "Frustration Plus". Anyway, here is how he tells it.

The fault I am about to describe was one of the most trying I have encountered for some time. I should explain that I work for a tertiary institution in the capacity of an audio-visual technician. Although, in this position, I have



Sanyo CTP6603 vertical scan circuitry. C451, part of an RC circuit across the side pincushion transformer, turned out to be the culprit.

seen many "curly" faults, I feel that this one takes the cake!

The set concerned was a Sanyo CTP6603 with the complaint that vertical scan had collapsed to about one quarter of normal height with some edge distortion – this latter clue proved to be a fairly important one in retrospect but, at the time, I merely noted that the fault involved the vertical section and headed there.

First, I made a voltage check at the midpoint of the class-A vertical output stage (Q901,902). This revealed about 8V instead of the 47V indicated on the circuit and my first thought was that there must be some fault within the DC-coupled vertical section, which consists of a Miller integrator with a transistor switch (Q403) which drives a compound emitter follower (Q421, Q422) which, in turn, drive the output pair already mentioned.

At this point the oscilloscope was brought into service to check waveforms. This confirmed my suspicions, as the output waveforms were nothing like those on the circuit. Feeling that there must be a DC fault in the vertical chain I began checking the transistors one by one. This proved inconclusive; they all checked out OK but I recalled recent comments in the Serviceman's notes about transistors checking OK, but still being faulty.

So I decided to replace them one at a time. Eventually, with all the small signal transistors replaced with no effect, I replaced the output pair. This involved additional time as I had no similar transistors, and had to improvise with a pair of 2N3055s which had been checked for high voltage. Another blank.

After yet another cup of coffee for deliberation (I sometimes wonder what the nervous state of electronics technicians would be, if deprived of that oft-needed period of inspiration), I felt that there must be some loading of the output stage. I therefore disconnected the link between the output stage and the yoke/convergence circuits, but this produced the same low voltage and incorrect waveforms at the output stage.

At this point it occurred to me that some component in the vertical output stage was still faulty so I mocked up the output circuit on the output transistors themselves, leaving the original components on the board – still no help. By this stage I had spent a whole day on the set, and decided to go home and meditate on my findings.

This produced a thought concerning AC and DC feedback loops from the end of the deflection and convergence yokes. Anyway, next morning, armed with a determination that the fault was not going to beat me, I connected the output stage back to the yoke circuits and investigated voltages and waveforms around the feedback circuits – these latter being rather odd configurations.

However, even when the feedback was disabled (wiper of vertical size trimpot VR441 to chassis) the situation did not vary much. By this time I was grasping at straws; a DC and AC-coupled cir-

cuit with feedback around the lot makes stage-by-stage fault finding very difficult.

At this stage I decided to check the yoke and pincushion transformers for shorted turns, feeling that if there were shorted turns this would load the output stage – even though it seemed that I had proved that these circuits were not loading the output stage, there was the possibility of feedback masking the test in some way.

Unfortunately, after more time spent removing and checking these with a shorted turns tester, they proved to be OK. (Incidentally, I regard a shorted turns tester as invaluable. It has saved me the time and expense of buying replacements unnecessarily on several occasions. My own unit was built from the July 1972 EA circuit.)

By now I had reached something of an impasse. So far I had followed the theory that the output stage was being loaded, even though previous tests seemed to disprove this. In desperation I decided to press on by testing every passive component in the yoke and convergence circuits.

Well, to cut another long story short, some time was spent checking each one until I came to C451, a 330μF bipolar electrolytic forming part of an RC network across a winding (pins 1 & 2) of the side pincushion transformer, T402. Imagine my feeling of relief, mixed with frustration, when I found it neither opened or shorted, but dried out to a value of about 5μF.

THE CURE — AT LAST!

Gingerly I strapped a pair of 500μFs back to back to replace it and with bated breath switched on – to be greeted with a perfect picture! How? Why? Frankly, I don't really know, particularly as I cannot see exactly what its function is in the circuit. The best theory I can come up with is that it provides waveform correction and, without this correction, the circuit is upset.

But why it had such a marked effect, and why it upset waveforms when both the feedback injection, and connection between the output stage and the yoke circuits were broken, is anybody's guess. I guess I'll leave that to the academics to discuss and postulate over.

Well, I'm afraid I must pass on that one also G.W., but the story does emphasise that modern sets are so complex that it is often impossible to grasp the working details, or follow the design engineer's reasoning. And, as I've demonstrated in these notes previously, even the agents' service departments are often at a loss to follow some circuits in detail.

Which means that G.W.'s approach is often the only one.

OK, that takes care of Western Australia and South Australia, so now we have something from one of my regular contributors, J.L. of Tasmania. He starts his story with the question; how many symptoms can a single fault cause?

The set concerned was a Rank Arena model 2230, and I was called in when the owner became fed up with an intermittent darkening of the picture. It had gone on for six months and she could stand it no longer.

When I switched the set on the picture came up bright enough, but badly out of focus. I was lucky in that the fault elected to show itself within a few minutes and I noted that the focus improved slightly as the picture went darker, though it remained poor.

I adjusted the focus control and found that a pin sharp picture could be obtained with the control near its centre position. When the brightness later returned to normal, the owner expressed surprise at the clarity of the picture. Apparently the set had been out of focus all its life, and no one had ever noticed!

Apart from the brightness variations, I had noticed another fault; rather severe side pincushion distortion, that was marginally worse when the picture was dark. The SPC control worked, but only over a limited range, and nowhere near enough to correct the distortion.

My first point of attack was the SPC transistor, TR415. With the set operating "normally", the collector voltage was about 56V, some 10V lower than that shown on the circuit diagram, with the base and emitter around the 2V mark. But under fault condition, the collector dropped to 30V and the base and emitter shot up to around 12V.

The TR415 collector is fed from the 120V rail, and this rail barely changed between the normal and fault conditions, so the fault had to be related to the bias on this stage. One unusual feature of this part of the circuit is that the bias is derived, not from the collector rail, but from the 18.5V rail (19V on other Rank models), and therein lay the clue to all the troubles.

When the fault was present the 18.5V rail shot up to 26V. With a normal picture the rail dropped back to 20.1V. The Serviceman has often noted faults in Rank 19V rails, so I turned back through the various articles and found a reference, in the June 1981 issue, to the very fault I was now seeing.

In that case one of the diodes in the 19V regulator network (D555, D559 & D560) had gone O/C. In my case one was obviously intermittent. However, as these are part of the zener stabilising chain I felt it would be wise to replace them with new diodes having the same voltage drop as the existing ones.

This revealed a rather surprising condition. Both diodes had a 1.3V drop which, together with the 18V across the zener, put 20.6V on the base of the regulator transistor and accounted for the 20.1V rail. I chose two new diodes, each of 0.5V, and fitted them. The 18.5V rail dropped back spot on, the SPC output collector went up to a normal 66V, base and emitter voltages dropped back to the figures shown on the circuit, and the side pincushion distortion disappeared.

Reference to the circuit shows that the SPC drive transistors are also fed from the 18.5V rail so that the output transistor was not only wrongly biased by a fault on the rail, but was also getting excessive drive, for the same reason. No wonder the picture was distorted.

In the various Serviceman articles referred to above, the symptoms of 19V rail trouble are given as; (1) no sound or picture, (2) brightness changes, (3) vertical overscan, (4) chroma dropout, and now (5) side pincushion distortion. Where will it all end?

A good question, J.L., but one which I wouldn't try to answer. However, the point which does seem to emerge is that, with any Rank Arena set of this vintage, the 19V rail should be checked as a matter of routine, particularly as it can suffer from quite small voltage changes and produce the most subtle faults. Anyway, I was glad my notes helped with your problem, J.L.

And finally, we shoot up to Queensland for a short, but interesting story from J.E., a professional serviceman on the Gold Coast. (There's a coincidence, but this is obviously not the J.E. from Western Australia.) Anyway, he writes;

The customer complained about his mantel radio that, "It works fine on 4GG (1200kHz) but whenever I try to tune 2MW (990kHz) it blows the mains fuse in the meter box." Intrigued, we removed the chassis and found that the original tension spring on the dial cord had apparently broken and been replaced by the customer.

Unfortunately, he had substituted a longer spring he had found "lying around the house." As 990kHz was approached it stretched and neatly shorted the active and neutral lugs on the on/off volume pot!

Fair enough, J.E., and I imagine that was good for a chuckle when you found it. At the same time, it points up the potential danger of people fiddling with things they don't understand. Anything which runs foul of mains terminals must be regarded as creating a risk to life or property, even though all ended happily in this case.

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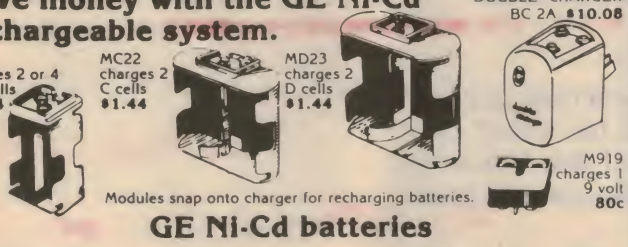

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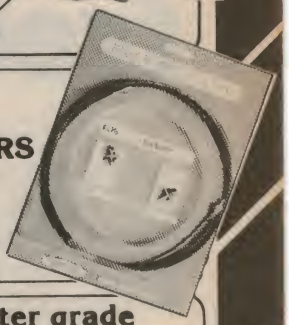

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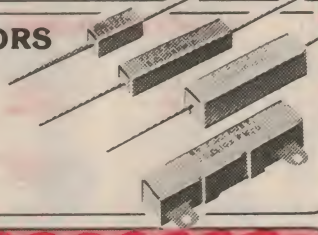

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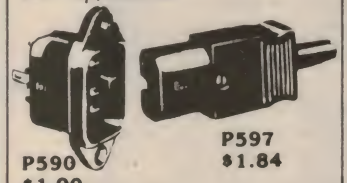

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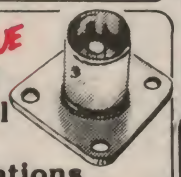

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EA5

Don't let frozen food go to waste!

Build this simple freezer alarm

Inexpensive and easy to build, this freezer alarm will help prevent your valuable frozen goods from being ruined in the event of a freezer failure. A buzzer warns you the moment the freezer's temperature becomes higher than normal — while you still have time to save the goods.

By COLIN DAWSON

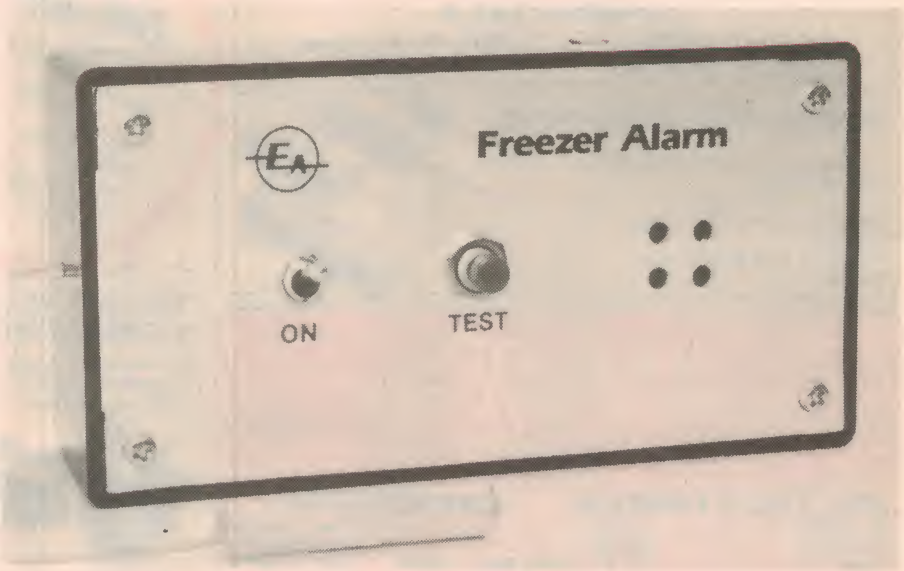
By allowing maximum advantage to be taken of "specials" and bulk purchasing, freezers are now a popular method of cushioning the spiralling cost of small goods. However, any cost advantage gained in this way can be immediately lost in the event of a freezer failure. Tens or even hundreds of dollars worth of small goods can be ruined as a result of a blown fuse or carelessly leaving the freezer door ajar.

This simple circuit is designed to guard against that possibility. It can be built for an outlay of around $20, uses readily available components, and is battery operated so that it will still work in the event of mains failure. Battery life, in normal circumstances, is around six months.

Of course, it's not only in domestic situations that our Freezer Alarm could save frozen foodstuffs. Owners of small corner stores usually have hundreds of dollars worth of stock stored in freezers, so any device that will effectively indicate a freezer failure has to be a worthwhile business investment. It could save both your ice cream and your customers!

Most of the circuit is housed in a plastic utility zippy box which can simply sit on or near the freezer to be monitored. A small probe mounts inside the freezer and is connected to the rest of the circuit by two wires. A test switch, situated on the front panel, checks the battery condition and verifies correct circuit operation.

Long battery life has been achieved by operating the circuit on a 1:10 duty cycle. In other words, the circuit is active for one second and then passive for 10 seconds. Current drain is 50μA in the passive state and 400μA during the active monitoring state, resulting in an average current drain of around 80μA.



The complete Freezer Alarm is housed in a small plastic box, and the panel we have prepared gives it a professional appearance. The sensing probe, which is normally in the freezer, is shown in front of the box.

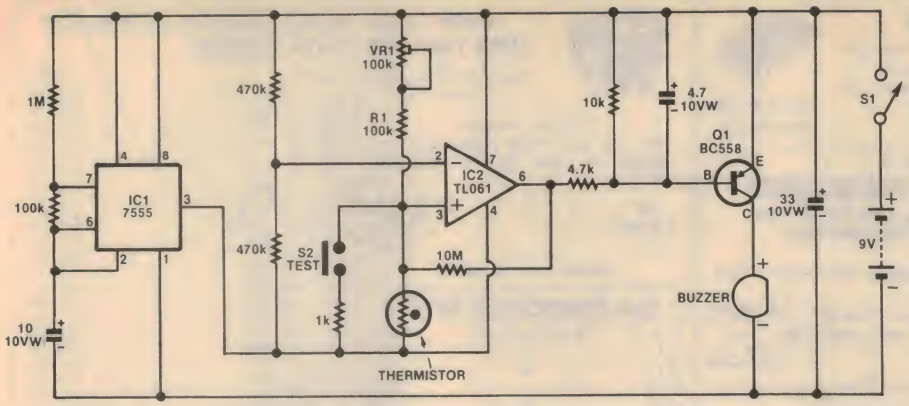
This increases to around 5mA (peak) when the alarm is triggered, due to the current drawn by the buzzer.

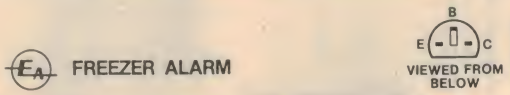
The one second on, 10 seconds off duty cycle is a compromise between reduced power consumption and the effectiveness of the alarm. When triggered, the buzzer will sound for one second every 10 seconds. This should prove satisfactory for most situations, although some readers may decide to increase the off period to reduce power consumption even further. The one second on period, however, can probably be regarded as a minimum.

Circuit diagram

The circuit diagram is straightforward and consists of a 7555 timer (IC1), a comparator (IC2), and a transistor driving a buzzer. IC1 is a CMOS version of the familiar 555 timer IC, and is wired here as an astable multivibrator to provide the 1:10 duty cycle. This 1:10 duty cycle is set by the 1MΩ and 100kΩ timing resistors and the 10μF electrolytic capacitor.

Here's how the 7555 works: Initially, the 10μF capacitor is charged to ⅓ supply voltage (ie ⅓Vcc) and the pin 3 output of IC1 is high. The 10μF capacitor now charges via the 1MΩ and 100kΩ timing resistors and, when it reaches ⅔Vcc 10 seconds later, the output at pin 3 goes low. The 10μF capacitor then discharges via the 100kΩ resistor and pin 7 and, when its voltage falls to ⅓Vcc after about one second, the pin 3 output goes high again and the timing cycle is repeated.





The circuit is a relatively simple one and it's operation should be easy to follow from the text. The basic sensing mechanism is associated with IC2, IC1 being used to give the 1:10 duty cycle and extended battery life.

As can be seen, the common rail for the comparator circuit (IC2) is connected to pin 3 of the 7555, rather than direct to the negative supply rail. This means that the comparator circuit is activated only when pin 3 of the 7555 goes low for one second at the end of each 10 second timing interval.

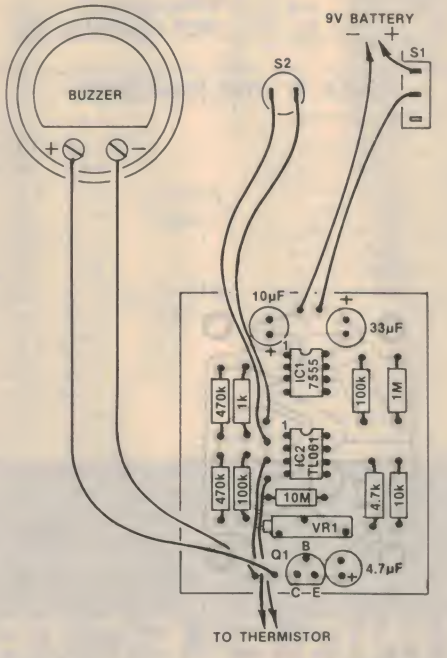
Hence we have the 1:10 duty cycle referred to above. When the output of the 7555 is high, the comparator circuit is off and the only current drawn from the battery will be that drawn by the 7555 itself. That is why we have used a 7555 in place of the familiar 555 – because it is a CMOS device, it's current consumption is far lower.

Comparator IC2 consists of a TL061 Fet-input op amp which is used to compare the sensor voltage (from the probe) with a reference voltage. In this circuit, the non-inverting input is used as the sense input, and the inverting input biased to ½Vcc by two 470kΩ resistors. Since both resistors have the same temperature coefficient, the output from this voltage divider will be virtually independent of ambient temperature.

A second voltage divider consisting of the 100kΩ trimpot (VR1), a 100kΩ resistor and a negative temperature coefficient (NTC) resistor biases the sense input (pin 3) of IC2. As the temperature rises, the resistance of the thermistor decreases, and thus the voltage on the sense input also decreases – ie the voltage across the thermistor is inversely proportional to temperature. By comparing the two voltages on the inputs to the comparator, it is possible to determine when the temperature of the probe exceeds a certain value, as preset by trimpot VR1.

Normally, the voltage on pin 3 is higher than the reference voltage on pin 2, so the output of IC2 is high and PNP transistor Q1 is held off. However, when the critical temperature is exceeded, the voltage on pin 3 drops below that on pin 2 and the output of the comparator swings low. Transistor Q1 now turns on and drives a piezo-electric buzzer connected between the collector and the negative supply rail.

Positive feedback for comparator IC2 is via a 10MΩ resistor connected between pins 6 and 3. This gives the comparator a degree of hysteresis and is necessary to ensure reliable triggering at the critical temperature. Note that the output of IC2 goes high whenever the pin 3 output of the 7555 is high, so Q1 is held off during the 10s passive period. The only time pin 6 of IC2 can go low is during the 1s active period, and then only if an over-temperature condition is detected.



Above is the component layout on the printed board while at right is the board pattern shown actual size.

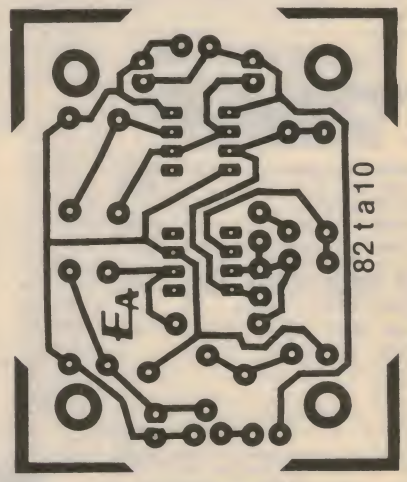
The 4.7kΩ resistor on the output of IC2 limits the transistor base current to a safe value while a 10kΩ pull-up resistor further ensures that the transistor is normally biased off. However, because the output IC2 does not swing fully to the supply rails, a click is produced by the buzzer each time the TL061 is activated by the 7555 unless further precautions are taken. The 4.7µF capacitor between the base of Q1 and the positive supply rail filters out these clicks, so that the buzzer remains silent until triggered.

Multi-turn trimpot VR1 allows the voltage on pin 3 of the comparator to be adjusted independently of temperature effects, so that the freezer alarm can be set to trigger at the required temperature. In addition, pushbutton switch S2 has been included to provide a battery check and test function. This switch and a series 1kΩ resistor are wired across the thermistor and, when S2 is depressed, a temperature high is simulated.

Power for the circuit is derived from a small 9V battery (Everready type 216, or similar). A 33µF 10VW electrolytic capacitor is added to give a low supply output impedance.

Construction

The first area of construction to be dealt with is the actual freezer probe. For this, you will require a 40mm length of plastic tubing with an inside diameter of approximately 5mm. This is used to house the thermistor; we found the body of a cheap ball point pen ideal for the purpose.



We estimate that the current cost of components for this project is approximately

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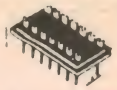

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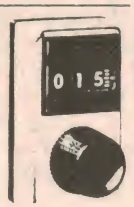

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Spectrol model 63P ACTUAL SIZE

STOCK VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K, 50K, 200K, 500K, 1M, 2M

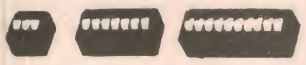
1—9	$1.00
10—99	0.90
100	0.80

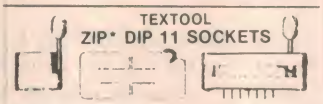
Values may be mixed.

DIP SWITCHES SPST

P/N	No of Switches	Price
SD3	3	$1.60
SD4	4	1.70
SD5	5	1.90
SD6	6	2.30
SD7	7	2.40
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

DIP SWITCHES SPST





TEXTOOL ZIP* DIP 11 SOCKETS

16 Pin Zip* Dip 11	$11.50
24 Pin Zip* Dip 11	12.50
40 Pin Zip* Dip 11	17.50

*Zero Insertion Pressure

INCREDIBLE MEMORY AND DISC DRIVE PRICES

	1-9	10-25	25+
2708	4.90	4.00	3.90
2716	4.90	4.20	3.90
2732	8.00	7.50	7.00
4116 (200nS)	1.95	1.80	1.75
4164 64K Dynamic	11.00	10.00	9.50
M58725P (2K x 8) Static	10.00	9.00	8.50

(As used in new 64K Static S100 PCB)
ALL PRICES INCLUDE SALES TAX

DISK DRIVES

MPI 51 $275.00 + 17.5% ST.
MPI 52 $385.00 + 17.5% ST
MPI 91 $415.00 + 17.5% ST
MPI 92 $515.00 + 17.5% ST

Mitsubishi 8"
$625 including tax.

RS232 & "D" TYPE CONNECTORS

PART NO	DESCRIPTION	1-9	10-25	25+
DE-9P	9 PIN MALE	$3.50	$3.50	$3.10
DE-9S	9 PIN FEMALE	4.50	4.20	3.90
DE-9C	9 PIN COVER	2.20	2.10	1.90
DA-15P	15 PIN MALE	4.50	4.20	3.90
DA-15S	15 PIN FEMALE	5.10	4.90	4.70
DA-15C	15 PIN COVER	2.30	2.10	2.00
DB-25P	25 PIN MALE	5.90	5.60	5.10
DB-25S	25 PIN FEMALE	6.90	6.60	6.10
DB-25C	1 pc Grey Hood	2.40	2.20	2.00
DB-25C2B	2 pc Black Hood	2.80	2.70	2.50
DB-25C2G	2 pc Grey Hood	2.70	2.50	2.40
DC-37P	37 PIN MALE	7.90	7.50	7.10
DC-37S	37 PIN FEMALE	10.90	9.90	9.10
DC-37C	37 PIN COVER	4.90	4.50	4.10
DH-S	Hardware set (2 Pairs)	2.10	1.90	1.80

BUILD YOUR OWN SPEAKERS WITH PHILLIPS

PART No	PRICE
AD0140T8	$11.86
AD01610T8	$16.95
AD01605-TB	$16.54
AD0162-T15	$18.78
AD0162-T15	$13.03
AD0162-TB	$13.77
AD0210-SQ8	$42.00
AD02160-SQ8	$45.00
AD02161-SQ8	$33.46
AD10100-W8	$52.72
AD12100-HP8	$85.10
AD12100-M15	$79.11
AD12100-M8	$79.11
AD12100-W8	$53.99
AD12200-W8	$73.12
AD12250-W8	$83.00
AD12650-W8	$59.00
AD2273-T8	$5.03
AD4060-W8	$19.06
AD5060-SQ4	$22.05
AD5060-SQ8	$22.05
AD5060-W8	$17.59
AD5061-MB	$17.08
AD70601-W8	$22.00
AD70620-M8	$21.54
AD7063-M8	$20.78
AD70630-M8	$20.78
AD70650-W8	$26.96
AD7066-W8	$26.96
AD80601-W8	$20.24
AD8061-W8	$20.24
AD80652-W8	$26.20
AD8066-W4	$27.66
AD8081-M8	$9.81
AD9710-M8	$41.11
ADF1600-8	$19.44
ADF500-4500-8	$19.44

DIODES

	10-99	100+
IN4001	6c	5c
IN4002	6c	5c
IN4004	7c	6c
IN4148	5c	4c
IN5404	30c	25c
IN5408	35c	30c
IN4007	12c	11c

HEATSINKS

High Thermal Capacity Black Anodised

	1-4 $	5-9 $	10-49 $	50-99 $	100-499 $	500 plus $
HS1 — 38mm	1.85	1.75	1.50	1.35	1.00	0.90
HS2 — 75mm	3.00	2.90	2.50	2.00	2.00	1.50
HS3 — 150mm	5.80	5.40	4.90	3.80	2.90	2.70
HS4 — 225mm	8.10	7.60	7.10	5.90	4.50	4.30
HS5 — 300mm	8.90	8.40	7.90	6.50	4.90	4.60

Unanodised

HS11 — 38mm	1.40	1.20	1.00	0.90	0.80	0.70
HS12 — 75mm	2.50	2.20	1.90	1.60	1.25	1.20
HS13 — 150mm	4.90	4.50	4.00	3.20	2.45	2.40

BLANK CASSETTES T.D.K.

TDK ADC60	1 for $3.60	10 for $26.00
TDK DC60	1 for $2.10	10 for $18.00
TDK ODC60	1 for $3.50	10 for $31.00
TDK SAC60	1 for $3.50	10 for $31.00
TDK SAXC60	1 for $5.70	10 for $46.00
TDK DC90	1 for $2.40	10 for $21.00
TDK ADC 90	1 for $3.50	10 for $30.00
TDK SAC 90	1 for $4.20	10 for $39.00
TDK ODC90	1 for $4.70	10 for $45.00
TDK SAXC90	1 for $5.50	10 for $49.00
TDK DC120	1 for $4.50	10 for $37.00
TDK ADC120	1 for $5.40	10 for $46.50

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ROD IRVING ELECTRONICS

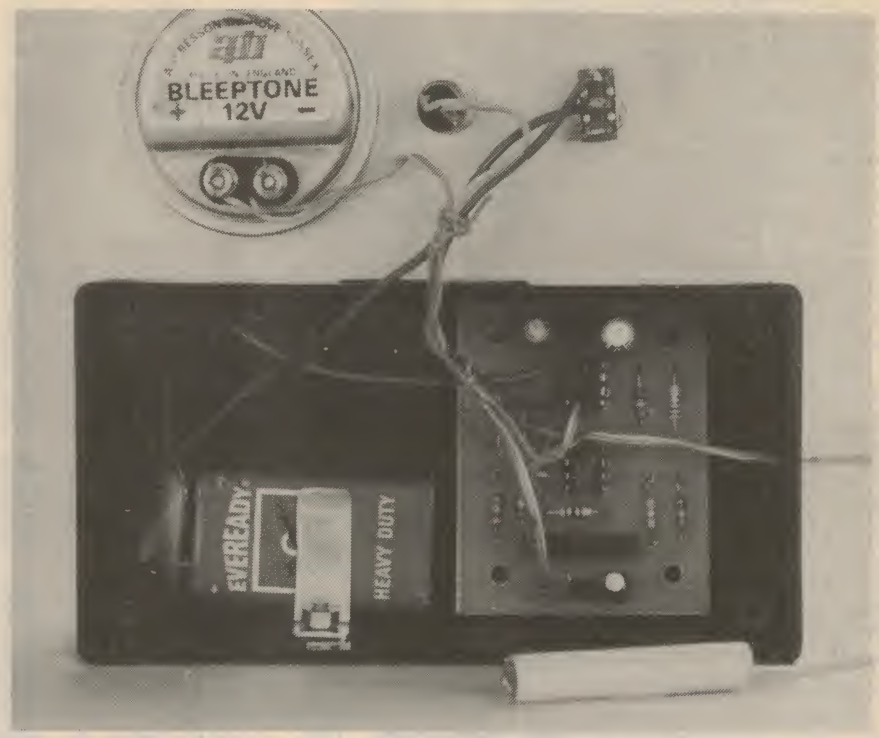
425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897

The length of 40mm is by no means critical, but there is probably no point in making it any smaller. Solder two wires to the thermistor leads and slide the assembly into the tube. The length of the wires will depend on how far the alarm is to be located from the freezer. We used about 1.5m and this should prove sufficient in most cases.

The thermistor used in the prototype was obtained from Dick Smith Electronics (Catalogue No. R-1792). Its specifications include a resistance of 47kΩ at 25°C and a working range from −25°C to +125°C, which make it ideal for this application. While it should be possible to use other themistors with similar specifications, it may be necessary to change the value of the 100kΩ series resistor to obtain correct operation over the required temperature range.

thermistor also warrants some comment. It needs to be as small as possible so as to interfere with the door seal as little as possible, and also moderately flexible to withstand normal movement. We used two wires peeled off together from a length of rainbow cable, but this may be a trifle wasteful for the home constructor. Very light duty figure-8 cable is probably the next best choice, or you may use just enough rainbow cable to reach the outside of the freezer, and then join this neatly to a length of figure-8 cable.

The temperature probe will need to be a waterproof assembly, as any moisture will cause erroneous alarms. Also, the thermistor should be just protruding from one end of the tube to ensure good thermal contact (this will prove an advantage in the calibration procedure). To seal the tube, pot both ends of the tube with an epoxy or silicone adhesive. This done, put the probe aside and turn to the printed circuit board (PCB).



This picture gives a good idea of how the various sections fit together in the plastic box. Note that the battery should be mounted so that it does not foul the piezo-electric buzzer.

The PCB is coded 82ta10 and measures 59 x 48mm. Before embarking on its assembly, note that the 7555 timer IC is not fitted until after the calibration procedure has been completed. Instead, a wire link must be temporarily fitted between the holes intended for pins 1 and 3. This allows IC2 to operate continuously and makes calibration much easier to carry out.

Begin assembly of the PCB by fitting the resistors, followed by the TL061 op amp, the transistor and the multi-turn trimpot. Finally, mount the three electrolytic capacitors. Note that the semiconductors and capacitors are all polarised, so make sure that you fit them the right way round.

For those situations where the freezer alarm will meet the critical eye of house guests, we have prepared a Scotchcal

Simple freezer alarm

front panel to greatly enhance its appearance. If you intend to use the front panel, it should be affixed to the lid of the case and the following holes drilled: 4 x 4mm for the mounting screws; 6.5mm for the power switch; 7.5mm for the test switch; and several holes as applicable for the piezo-electric buzzer. Note that the buzzer is held in place with epoxy adhesive – the holes are simply to allow the sound to escape. In fact, the buzzer can be glued in place when all the holes are drilled.

Attention can now be turned to the plastic utility (zippy) box. All that is required is to drill a hole at one end of the box for the sensor wires and to install a battery clip. The size of the hole required for the sensor wires will depend on the wires you have used – we found 2.5mm large enough. The battery clip can be manufactured from a piece of scrap aluminium of approximately 10 x 35mm. Before mounting the battery clip, make sure that the battery will clear the piezo-electric transducer.

All that remains of construction for the moment is to complete the wiring. This includes wiring to the sensor probe, the piezo-electric buzzer, the power switch, the battery and the test switch. The PCB can now be clipped into the integral supports in the case or, if you prefer, installed using machine screws and nuts.

To test the unit, set the multi-turn trimpot fully clockwise (keep turning the adjusting screw until you hear the clicks) and temporarily short out the fixed 100kΩ (R1) resistor with a wire link. Now switch the freezer alarm on. The buzzer should immediately emit a continuous alarm tone and you should be able to cancel this by adjusting the trimpot anti-clockwise.

Correct circuit operation can now be verified by pushing the test button or by heating the sensor slightly. In both cases, the alarm should re-trigger. The circuit is now ready for calibration, but first switch the unit off and remove the shorting link across the 100kΩ resistor. (Note: The link is only necessary to allow the unit to be tested with the probe at room temperature.)

Calibration

Freezers normally operate in the temperature range −15°C to −18°C and the freezer alarm should be calibrated to trigger at about 5°C above this. Prior to calibration, the probe should be placed in the freezer for several hours or, preferably, overnight. The alarm should be switched off during this period.

Note that the probe should be placed somewhere near the bottom (or back) of the freezer so that it will be unaffected by temperature fluctuations due to the freezer door being opened.

When the probe temperature has stabilised, switch the unit on and slowly turn the trimpot clockwise until the alarm just sounds. Finally, turn the trimpot 2½ to 3 turns anti-clockwise again. Your Freezer Alarm is now calibrated to trigger at approximately 5°C above the normal temperature of the freezer (one complete turn of the trimpot is equivalent to a temperature change of around 2°C.

We should point out here that freezers in domestic refrigerators usually operate at higher temperatures than stand-alone freezers, a typical figure being −5°C. In this case, the Freezer Alarm should be calibrated to trigger at around 0°C. You can do this by immersing the probe in an ice-water mixture and then suitably adjusting the trimpot so that the unit just triggers.

With calibration completed, remove the wire link from the printed circuit board and install the 7555. This is a CMOS device, so the usual precautions should be taken: earth the barrel of your soldering iron to the negative supply rail on the PCB (use a small clip lead), and solder the supply pins (1 and 8) first.

As a final check, switch the unit on and press the test switch. There should be 10 seconds of silence and then the alarm should sound for one second. If this is the case, your Freezer Alarm is ready for service but don't forget to check the battery condition at regular intervals.

PARTS LIST

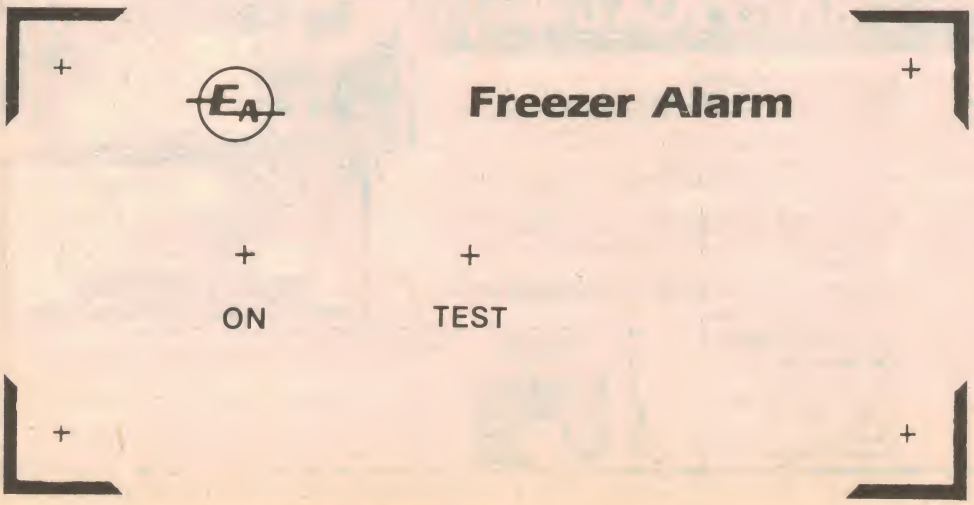
1 printed circuit board, code 82ta10, 59 x 48mm
1 plastic utility case, 40 x 68 x 130mm
1 Scotchcal front panel, 125 x 63mm
1 SPST miniature toggle switch
1 SPST momentary contact pushbutton switch
1 9V piezo-electric buzzer
1 9V battery and clip
1 ballpoint pen tube, or similar (see text)

SEMICONDUCTORS
1 7555 CMOS timer
1 TL061 Fet-input op amp
1 BC558 PNP transistor

CAPACITORS
1 33µF/10VW PC mounting electrolytic
1 10µF/10VW PC mounting electrolytic
1 4.7µF/10VW PC mounting electrolytic

RESISTORS (5%, ¼W)
1 x 10MΩ, 1 x 1MΩ, 2 x 470kΩ, 2 x 100kΩ, 1 x 10kΩ, 1 x 4.7kΩ, 1 x 1kΩ, 1 x 100kΩ multi-turn trimpot, 1 x 47kΩ NTC thermistor (see text)

MISCELLANEOUS
Hook-up wire, rainbow cable, machine screws and nuts, scrap aluminium for battery clamp, epoxy adhesive, solder, etc.



The front panel, shown actual size. These should be available from various component retailers when this article appears.

NEW STORE opening October in Carlingford

AT "NEVILLES'S CORNER" CNR CARLINGFORD & PENNANT HILLS RD. NEXT TO KENTUCKY FRIED CKICKEN

AUDIO KITS – -JAYCAR IS No1 sub woofer sensation

Ref: Electronics Australia June-August 1982

THE SUB-WOOFER

MODEL SW 250

Recall Notice
Some subwoofers sold in August did not conform to our published specs. The free air resonance may be over 32Hz. If your unit was supplied before the 1st of September and DOES NOT have a silver label on the back magnet, please return it to us for free replacement.

ONLY $79.50

This unit has been extremely popular with audio enthusiasts right across Australia! EA have designed a special crossover/booster amp just for this unit. Now you have no excuse to build a subwoofer system to enjoy those thrilling low notes from pipe organs, synthesisers, 1812 cannons etc!!

SPECS:
Diameter 10" (250mm) Cast Frame. QT=0.39. VAS=631 Power Handling = 100WRMS. Free-air Resonance 32Hz ±1Hz Voice Coil = 2" (51mm). Dia. Magnet Assy = 3kg (6.6lbs).
A FREE SUB-WOOFER CABINET DESIGN IS PROVIDED WITH EACH UNIT!!

THE ENCLOSURE

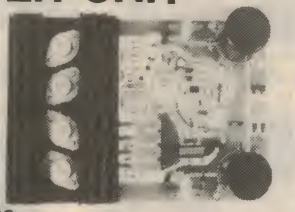
ONLY $79.50

This compact 63 litre vented enclosure was specifically designed around the parameters of the SW250 Sub-Woofer. It follows the theory pioneered by the work of Thiele, Small and Snyder. The Jaycar enclosure is easy to build and is made of high quality durable materials. The heavy walled cabinet is covered with an attractive black vinyl veneer. All timber is pre-cut and the black grille is already made. Assembly takes less than one hour.
NB. The photo shows the prototype which was finished in white. The production units are only available in black
Freight anywhere in Australia only $10.00.

AMPLIFIER/FILTER UNIT

AMPLIFIER/FILTER UNIT.
Amplifier Module $79
Transformer to suit $39.50
Metal case specially made to suit including front panel, hardware etc.(not a twin 25 case). Only $29.50
$148.00
Buy the lot for only $125.00 if you purchase the enclosure and woofer at the same time.

ONLY $79



REF. EA JULY 1982
State-of-the-art power Mosfet technology combined with an active low pass filter results in a sub-woofer amp without equal anywhere!!
FEATURES: Around 100WRMS Drive capability.
Low pass (sub-woofer) filters on board.
Can hook-up to pre-amp out or power-amp out.
Power supply on board.
(Transformer needed. ONLY $39.50)

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EA KITS

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Cudlipp Cricket – Circuit drives you crazy Ref: EA2/82	$12.50
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Metronome – Stick to the beat when learning Ref: EA2/82	$16.95
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EPROM Programmer – Cheap EPROM programming Ref: EA1/82	$59.00
Guitar Booster – Play your guitar on the Hi Fi Ref. EA6/82	$14.50
Onscreen Graphic Analyser – a must for the audiophile EA9/81	$106.00
Cassette Deck Audio Test Unit Ref: EA10/81	$45.00
Musicolour IV – Coloured lighting for your Hi Fi	$85.00
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445 – General Purpose Preamp	$8.50
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581 – +15V @ 200mA Power Supply. Tranny included	$17.50
330 – Car Alarm – works well	$29.50
492 – Sound Bender – Dalek!!	$24.50
446 – Audio Limiter	$12.00
479 – Bridging Adaptor ETI3/82	$9.95
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498 – Preamp for above	$39.50
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480/100 – 100W Economy amplifier – quality version	$27.00
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729 – UHF Masthead Amplifier	$35.00
735 – UHF Convertor	$32.50
477 – 5000 Series MOSFET Module – Quality	$59.00
478MC – 5000 Series Moving Coil Preamp	$29.50
478MM – 5000 Series Moving Magnet Preamp	$19.50
458 – 5000 Series Peak Reading Level Meter	$29.50

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HE104 – Simple AM Tuner July 1981	$7.50
HE105 – Basic Amplifier July 1981	$9.75
HE106 – Wireless Microphone July 1981	$6.50
HE107 – Electronic Dice August 1981	$5.95
HE108 – Power Supply August 1981	$11.95
HE110 – Unmistakabell September 1981	$6.95
HE111 – Ohmmeter September 1981	$19.95
HE112 – Micromixer September 1981	$12.00
HE113 – Water Alarm September 1981	$9.50
HE114 – Digital Counter/Display October 1981	$13.95
HE115 – Reaction Timer ******** November 1981	$6.95
HE116 – OP Amp Tester October 1981	$3.95
HE117 – House and Car Alarm October 1981	$16.95
HE121 – Scratch and Hiss Filter October 1981	$8.50
HE123 – Alien Invaders November 1981	$13.95
HE126 – NiCad Charger November 1981	$9.95
HE127 – Siren September 1981	$3.95
HE128 – Foghorn September 1981	$5.95
HE129 – Simple Timer November 1981	$6.95

JAYCAR STOCKS QUALITY KIT VERSIONS OF MOST EA, ETI & HOBBY ELECTRONICS

******** HE114 also required for complete operation.

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AS REVIEWED IN ELECTRONICS AUSTRALIA AUGUST 1982
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$10 freight anywhere in Australia.

12 band
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** NEW KIT **

Ref: Electronics Australia October 1982.
Simple little circuit fits into an old plastic fluoro lamp starter. Lights turn on without a flicker. Great for bathrooms.

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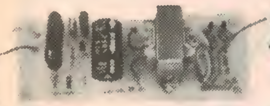
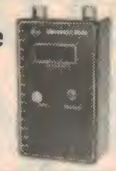
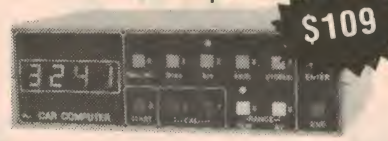


Ultrasonic Rule — $49.00

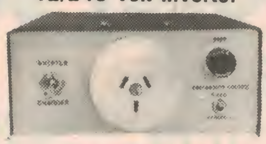


Car Computer — $109

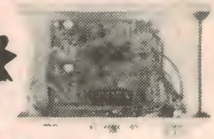


Tacho/dwell meter with digital display — $62

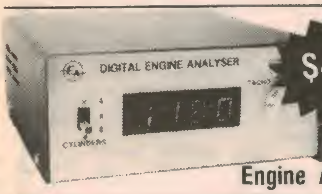
12/240 volt Inverter — $55



Universal preamplifier for MM/MC cartridges — $35



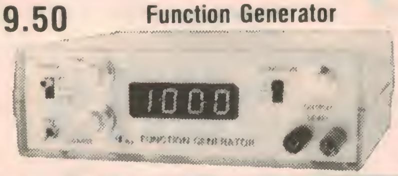
Engine Analyser Kit — $48.50



Eprom Programmer — $55.00

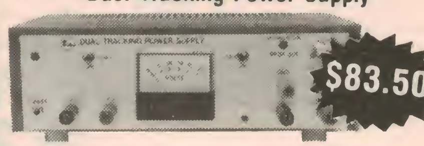
Analogue and Digital Storage CRO Kit — $189.00

Function Generator — $79.50

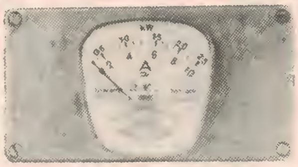


$55.00

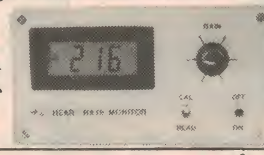
Duel Tracking Power Supply — $83.50



Power Monitor — $18

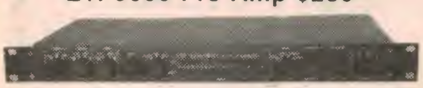


Portable 3½ Digit Heart Rate Monitor — $79.00



100w Sub-Woofer Amplifier — $85.00

ETI 5000 Pre Amp $239



Come in and hear the fantastic combination of the ETI5000 power amp & preamp playing through the ETI4000/1 and 2 speaker systems. EX STOCK.

ETI POWER AMP ONLY $279

The front panel is now better finished than ever and has no holes visible. The fins themselves are tapped from the rear. Complete kit price is just $275. Remember the super finish front panel at no extra charge. EX STOCK.
We have now sold 150 of this kit and expect to sell hundreds more.

LE GONG

Fantastic doorbell using the new Siemens SAB 0600 chip.
Kit of parts $15

INCREDIBLE!!!

E/A has really done it this time. Display your Hi/Fi response on your colour TV. It will really impress your friends. Kit of parts $99

Over 200 Sold

			$
ET729	UHF TV Masthead Amp	Apr 81	36.00
ET730	UHF TV Converter	May 81	37.50
ET760	Video Mod. to suit 660 Micro	Spt 81	14.50
ET1501A	Negative Ion Generator	Apr 81	39.00
	Dream 6800		109.00
	Dream 6802		109.00
	Pwr. Supply to suit Dream Micro Kit		29.50
	Hex Keypad 19 Keys		28.50
79TI11	Transistor Assisted Ign.	Nov 79	34.00
79UPS6	Universal Power Supply	Jun 79	29.50
80TC12	Bipolar Train Controller	Dec 80	28.00
80CM3A	Digital Capacitance Mtr	Mar 80	52.50
80PG6	TV Pattern Generator	Jun 80	52.50
80TV8	TV CRO Adapter	Aug 80	29.00
80LL7	Leds & Ladders	Jul 80	19.50
80BM10	Car Battery Monitor	Oct 80	6.50
80SA10	Stereo Amp Mosfet	Jan 81	169.00
80DC10	Digital Storage Cro Ad.	Nov 80	78.00
80LS12	Selectalott	Dec 80	22.50
80LBR12	Light Beam Relay	Nov 80	13.00
80FB12	Guitar Fuzz Box	Dec 80	19.50
80TM8A	Digital Engine Analyser	Aug 80	48.50
80PP7A	Eprom Programmer	Jul 80	72.50
80RM12	CylonVoice Stimulator	Jan 81	18.50
80RAM12	RAM Expansion for Dream	Dec 80	39.00
80PA6	Playmaster 300W Amp Module	Jun 80	63.00
80TRS11	TRS 80 Printer Serial In.	Nov 80	15.00
81DC2	Le Gong Doorbell	Feb 80	15.00
81GA3	Colour Graphic Analyser	Mar 81	99.00
81IR4A	Infra-Red Relay	Apr 81	39.00
81SP1	RS232 TRS80 System 80 In.	Feb 81	15.00
81SW1	Oscilloscope Switch	Feb 81	58.00
81DC3B	Digital/Analog Store. Cro.	Mar 81	169.00
81WS10	Wind Speed Indicator	Oct 81	43.50
81P6	Pool/Lotto Selector	Jun 81	24.50
81A010	Audio Test Unit Cass. Deck	Oct 81	47.50
81MC8	Musicolour IV	Aug 81	79.00
81SG9	LED Sandglass	Spt 81	22.50
81CI9	Digital Clock Thermometer	Spt 81	80.00
81SS11	Slide Cross Fader	Nov 81	80.00
81GA9	Photon Torpedo Game	Spt 81	23.50
81SW7	Train Steam Whistle	Jul 81	17.50
81HB4A	Heart Rate Monitor	Apr 81	84.00
81SP5	Sound Pressure Meter	May 81	37.00
81OR7	Electronic Organ	Jul 81	59.00
81CH12	Christmas Decoration	Dec 81	15.00
81fm10a	500MHz Digital Freq. Mtr.	Dec 81	135.00
HE102	Guitar Phaser	Jun 81	25.00
HE103	Transistor Tester		9.40
HE104	AM Tuner	May 81	7.50
HE105	Basic Amplifier	May 81	9.50

			$
HE106	FM Radio Microphone	May 81	6.50
HE107	Electronic Dice	Jun 81	5.95
HE108	Power Supply		11.95
HE110	Unmistakabell		6.90
HE111	Ohmeter		19.90
HE112	Micromixer		11.90
HE117	House and Car Alarm		16.90
HE121	Scratch and Hiss Filter		9.00
HE127	Siren		3.90
ET043	Heads or Tails	Oct 76	3.50
ET044	Two Tone Doorbell	Oct 76	4.50
ET047	Morse Practice Set	Dec 76	3.50
ET048	Buzz Board	Dec 76	3.90
ET061	Simple Audio Amp	Oct 76	5.50
ET062	Simple AM Tuner	Mar 77	6.50
ET063	Electronic Bongos	Nov 79	5.00
ET065	Electronic Siren	Dec 79	5.50
ET066	Temp Alarm	Dec 79	4.90
ET068	LED Dice	Oct 76	5.90
ET072	Two Octave Organ	Jne 78	8.50
ET084	Car Alarm	Jan 77	12.00
ET147	Electronic Dummy Load	Oct 80	89.00
ET149	2 Tone Generator	Jul 80	34.90
ET157	Crystal Marker	Uct 81	34.50
ET158	Low Ohms Meter	Nov 81	29.50
ET256	Humidity Meter		19.50
ET257	Universal Relay Board	May 81	12.50
ET258	Mini Drill Speed Controller	Jul 81	8.00
ET326	Exp. Scale LED Voltmeter	Spt 80	12.50
ET327	Turn/Hazard Indicator	Oct 80	22.00
ET328	LED Oil Temp Meter	Jan 81	15.50
ET329	Exp. Scale Vehicle Ammeter	Feb 81	19.00
ET330	Car Alarm	Jul 81	27.50
ET332	Electronic Stethoscope	Aug 81	34.00
ET438	LED Level Meter		11.95
ET445	General Purpose Preamp	Jul 76	8.50
ET455	Loud Speaker Protector	Mar 80	25.50
ET458	LED Level Meter	Jne 81	27.00
ET466	300W Amp Module	Feb 80	63.00
ET467	4 Input Mike Preamp	Jul 80	27.50
ET470	60W Amp Module Series 4000 TPV 6		26.00
ET471	Audio Preamp Series 4000 TPV 6		45.50
ET472	Power Supply for Series 4000 TPV 6		24.00
ET473	Moving Coil Preamp Series 4000 TPV 6		54.00
ET475	AM Tuner	Spt 80	89.00
ET476	Series 3000 Amp 25W Stereo	Nov 80	84.00
ET477	Series 5000 Pwr. Amp Mod 150W	Jan 81	58.00
	Series 5000 Pwr. Amp Complete Kit		275.00
ET478MC	Moving Coil Preamp (5000)	Spt 81	18.50

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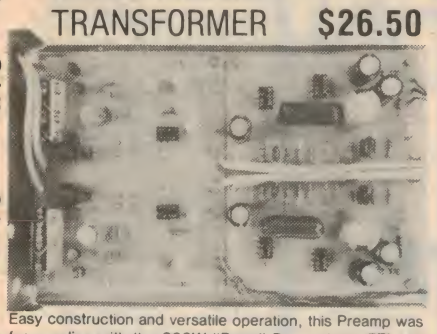
Post & Pack $2.50 small kits, heavier kits add extra postage
Prices subject to change without notice. Send 60c and SAE for pricelists. Phone (03) 489 8131.
MAIL ORDERS: PO Box 235, Northcote, Vic 3070.

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897

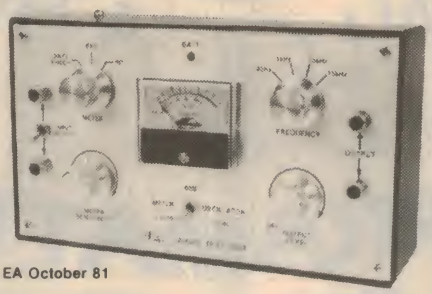
KITS

MIXER PREAMP TRANSFORMER $26.50



Easy construction and versatile operation, this Preamp was for coupling with the 300W "Brute" Power Amp. **ETI 467 July 80**

AUDIO TEST UNIT FOR CASS DECKS $47.50

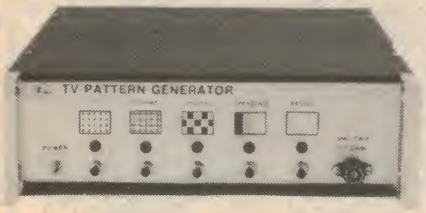


EA October 81

CRYSTAL MARKER (INC 1MHZ X) $34.50

ETI 157 October 81

TV PATTERN GENERATOR $57.50

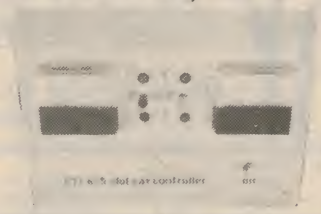


Adjust your TV for a first-class picture with EAs crystal controlled TV Pattern Generator. **EA June 80**

BIPOLAR TRAIN CONTROLLER $28.50

EA December 80

SLOT CAR POWER CONTROLLER (WITHOUT CASE) $70.00



ETIs Slot Car Controllers will put more zip in your slot cars zap. Plus Power Supply as indicated. **ETI December 81.**

ETI 477 MOSFET MODULE $58.50

Remember the great ETI 5000 power amp. With this module as the hub of the ETI 5000 and a transformer you get an amazing power output of 150W RMS.

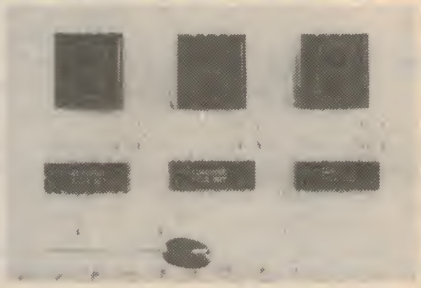
Plus Power Supply (No Trans)	$49.00
Plus Transformer	$39.50

PC BIRDIES $14.50

Granny's Birthday – PC Birdies.
Grannys got a birthday coming up and you don't know what to give her! Her cat ran away, her dog starved and the fish turned upside down. Well here's the perfect gift. A no-nonsense, no maintenance companion. The PC Birdies — She'll whistle, sing and dance for hours to this amazing electronic canary. **EA May 81**

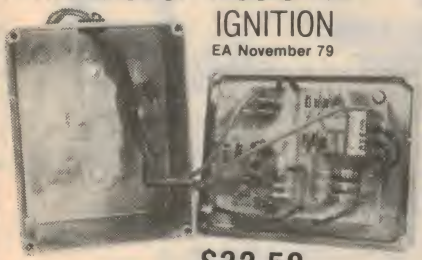
DIGITAL COUNTER DISPLAY $13.50

HE 114 HOBBY ELECTRONICS October 81



TRANSISTOR ASSISTED IGNITION

EA November 79



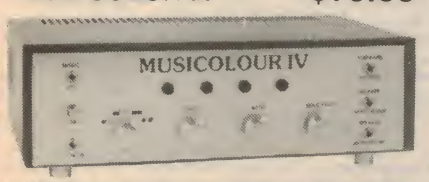
$32.50

WIND SPEED INDICATOR $43.50

October 81

ETI 50W MODULE	$17.50
ETI 100W POWER AMP	$22.00
VERSATILE EPROM CARD	$115.00
MOVING COIL PREAMP	$24.50
MOVING MAGNET PREAMP	18.50
DREAM 6800	$109.00
445 STEREO PREAMP	$8.25

MUSICOLOR IV $79.00



Add excitement to parties, card nights and discos with EAs new Musicolor IV light show. This is the latest in the famous line of Musicolors and it offers features such as four channel "Color Organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety. **EA August 81**

ETI SERIES 5000

Power Amp	$289.00
Pre-Amp	$239.00

NEW LOCATION FOR OUR PARRAMATTA STORE

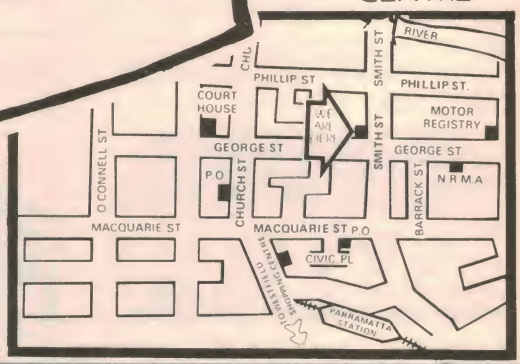
NEW STORE ADDRESS:
Cnr SMITH & GEORGE STS. PARRAMATTA

OPENS EARLY OCTOBER
For details of our other stores see below.

☆ ON SITE PARKING

☆ CLOSE TO PUBLIC TRANSPORT

☆ CLOSE TO WESTFIELD SHOPPING CENTRE



Dear Customers,

Quite often the products we advertise are so popular they run out within a few days. Or unforeseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally an error might slip through our checks and appear in the advert (after all, we're human too!). Please don't blame the store manager or staff - they cannot solve a dock strike on the other side of the world, or fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give the store a call first - just in case. Thanks.

Dick Smith and Staff

100% AND PROUD OF IT!

DICK SMITH Electronics

MAIL ORDER CENTRE
PO BOX 321, NORTH RYDE NSW 2113
Telephone orders: (02) 888 3200

STORE LOCATIONS

NSW	145 Parramatta Rd	AUBURN	648 0558
	T55 Terrace Level	BANKSTOWN SQ.	707 4888
	613 Princes Hwy	BLAKEHURST	546 7744
	552 Oxford St	BONDI JUNCTION	387 1444
	818 George St	BROADWAY	211 3777
	531 Pittwater Rd	BROOKVALE	93 0441
	147 Hume Hwy	CHULLORA	642 8922
	162 Pacific Hwy	GORE HILL	439 5311
	396 Lane Cove Rd	NORTH RYDE	888 3200
	30 Grose St	PARRAMATTA	683.1133
	6 Bridge St	SYDNEY	27 5051
	125 York St	SYDNEY	290 3377
	173 Maitland Rd	TIGHES HILL	61 1896
	263 Keira St	WOLLONGONG	28 3800
	Tamworth Acde & Kable Ave	TAMWORTH	66 1961
ACT	96 Gladstone St	FYSHWICK	80 4944
VIC	399 Lonsdale St	MELBOURNE	67 9834
	260 Sydney Rd	COBURG	383 4455
	656 Bridge Rd	RICHMOND	428 1614
	Springvale & Dandenong Rds	SPRINGVALE	547 0522
	205 Melbourne Rd	GEELONG	78 6766
	Ross Smith Ave & Nepean Hwy	FRANKSTON	783 9144
QLD	293 Adelaide St	BRISBANE	229 9377
	166 Logan Rd	BURANDA	391 6233
	842 Gympie Rd	CHERMSIDE	59 6255
SA	60 Wright St	ADELAIDE	212 1962
	435 Main North Rd	ENFIELD	260 6088
	Main South & Flagstaff Rds	DARLINGTON	298 8977
WA	414 William St	PERTH	328 6944
	Wharf St & Albany Hwy	CANNINGTON	451 8666
TAS	25 Barrack St	HOBART	31 0800

STORE HOURS

All Dick Smith stores are open from 9am to 5.30pm (Saturday 9am to 12 noon) except Queensland stores which open and close half hour earlier. Many stores are open for late night trading. Phone your nearest store for details.

POST & PACKING CHARGES

ORDER VALUE	CHARGE	ORDER VALUE	CHARGE
$5.00-$9.99	$1.40	$50.00-$99.00	$4.60
$10.00-$24.99	$2.40	$100.00 or more	$6.20
$25.00-$49.99	$3.50		

Charges are for goods sent by post in Australia only — not airmail, overseas or road freight.

SPEEDY PHONE/BANKCARD ORDER SERVICE

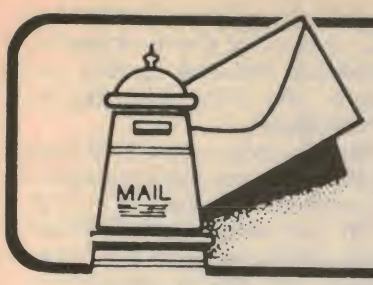
Just phone through your order and Bankcard details — it's so simple!

(02) 888 3200

MAJOR RESELLERS

These are our major resellers. However, we cannot guarantee they will have advertised items in stock or at the prices advertised.

Atherton QLD: Jue Sue's Radio Service, 55 Main St 91 1208 ● **Bendigo VIC**: Sumner Electronics, 7 Edward St 43 1977 ● **Ballina NSW**: A. Cummings & Co 91-93 River St 86 2285 ● **Broken Hill NSW**: Crystal TV Rentals, 166 argent St 6897 ● **Cairns QLD**: Thompson Instrument Services, 79-81 McLeod St 51 2404 ● **Coffs Harbour NSW**: Coffs Harbour Electronics, 3 Coffs Plaza, Park Ave 52 5684 ● **Darwin NT**: Kent Electronics, 42 Stuart Hwy 81 4749 ● **Darwin NT**: Ventronics, 24-26 Kavanagh St. ● **East Maitland NSW**: East Maitland Electronics, Cnr Laws & High Sts 33 7327 ● **Geraldton WA**: KB Electronics & Marine, 361 Main Terrace 21 2176 ● **Gladstone QLD**: Purely Electronics, Shop 2, Cnr Herbert & Auckland Sts 72 4321 ● **Gosford NSW**: Tomorrow's Electronics & Hi Fi, 68 William St. 24 7246 ● **Kingston TAS**: Kingston Electronics Channel Court 29 6802 ● **Launceston TAS**: Advanced Elctronics, 5a the Quadrant, 31 7075 ● **Lismore NSW**: Decro Electric, 3A 6-18 Carrington St 21 4137 ● **Mackay QLD**: Stevens Electronics, 42 Victoria St 51 1723 ● **Maryborough QLD**: Keller Electronics, 218 Adelaide St 21 4559 ● **Mt Gambier SA**: Hutcheson's Comm. 5 Elizabeth St 25 6404 ● **Mildura VIC**: McWilliam Electronics, 40 Lemon Ave 23 6410 ● **Morwell VIC**: Morwell Electronics, 128 George St 72 7423 ● **Nambour QLD**: Nambour Electronics, Shop 4, Lowan House, Ann St. 41 1604 ● **Orange NSW**: M & W Electronics, 173 Summer St. 62 6491 ● **Penrith NSW**: Acorn Electronics, Shop 12, 541 High St. 36 1466 ● **Port Macquarie NSW**: Hall of Electronics, 113 Horton St 83 5486 ● **Rockhampton QLD**: Purely Electronics, 15 East St 21 058 ● **Southport QLD**: Amateurs Paradise, 121 Nerang St 32 2644 ● **Toowoomba QLD**: Hunts Electronics, 18 Neil St 32 9677 ● **Townsville QLD**: Tropical TV, 49 Fulham Rd, Vincent Village 79 1421 ● **Traralgon VIC**: Power 'n Sound, 147 Argyle St 74 3638 ● **Wagga NSW**: Wagga Wholesale Electronics, 82 Forsyth St ● **Wodonga VIC**: A & M Electronics, 78a High St 24 4588 ● **Whyalla SA**: Mellor Enterprises, Shop 2, Forsythe St 45 47 64



Letters to the editor

Micro Invaders: the author replies

As a regular reader of your magazine I must admit astonishment at the intemperance of your review of my recently published book, "Micro Invaders". It was a marked contrast to the sort of straightforward book review I am used to reading in your columns.

Of course book reviews are intended to reflect opinion but when they descend to abuse I feel obliged to reply. I am taken to task by your reviewer for suggesting that the appeal of fibre optics over copper cable rests partly in the availability of its raw material and its requirement for fewer repeaters. I regard the first matter as self-evident and as for the second would point your reviewer to work by British Telecom engineers who have recently set world records in fibre optic transmission.

If that assessment of the potential of fibre optics "displays a woeful lack of understanding of the technology involved" I would direct your reviewer to the many telecommunications authorities throughout the world now using fibre optics. A few days before reading your review I was discussing just those advantages of fibre optics with the Hong Kong telephone authority. It intends to cable the whole city with fibre optics.

I am quite prepared to swap technical notes with your reviewer on any of the technologies discussed in "Micro Invaders" but that is not the point of the book. It is intended for a non-technical readership wanting a picture of what is happening technologically in the office, home and industry. There has been a strong reaction to the book, both for and against its opinions. No one has yet challenged its accuracy in describing the technology.

There appears to be a furphy in technical writing that only the experts can understand high technology. Fortunately, that is false. Often when the unnecessary buzz words are culled and ordinary English is used, it is possible to describe technology in terms which can be understood by most people. I have never subscribed to the view that understanding technology should be the province of the few. One of the difficulties in publishing technical magazines is communicating beyond the boundaries of those in the know to those who would like to be. If the secrets of electronic technology remain locked up by the experts, can you wonder that there is fear and distrust about the effects of technology?

Incidentally, an international edition of "Micro Invaders" will be published in the United States next year. If your reviewer promises not to hurl it around the room, I'll sent him another copy.

Ian Reinecke,
Chippendale, NSW.

Comment

Surely, the mere fact that raw materials for a technology are plentiful is no particular attraction in itself. After all, sand is also the raw material for solar cells but that does not make them cheap to manufacture.

As far as the comparison between boosters required for optic or conventional cables is concerned, it is only just recently that optic cables have begun to look competitive.

Where your assessment "displays a woeful lack of understanding" is that it neglects the main advantage which is bandwidth, while ignoring the difficulties of manufacture and installation. The greater potential bandwidth of optic cables means that they are capable of much higher rates of information or data transmission. At the same time, the optic mode means that information transmission is unaffected by very "noisy" electrical environments and "crosstalk" between adjacent optic cables is negligible.

We agree that technical writing can and should use terms which can be understood by most people. We try to do this as much as possible in this magazine. However, this purpose is not served by trivialising the issues being discussed, by drawing false analogies or by skating over the difficult bits. Any explanation must be technically correct.

In fact, that is the great challenge in writing on technical matters for the general public. How do you make it understandable to the completely uninformed while not insulting the intelligence of the informed reader? We stand by our review.

In this month's Book Review pages there is yet another example of an "intemperate" review so you have not been singled out.

Beryllium — don't breathe the dust either

I noticed with interest in your June 1982 issue, p49, that an advertisement for Jaycar indicated that beryllium oxide washers were "perfectly safe if not EATEN".

In fact beryllium oxide in the form of dust is an extremely toxic material having a threshold limit value of 2mg/m³ as beryllium and is stated by the American Conference of Governmental Industrial Hygienists as an industrial substance suspect of carcinogenic potential for man. The grinding or cutting of berylium oxide washers can give rise to dusts.

I believe the notation "perfectly safe if not EATEN" should be withdrawn and "dusts from beryllium oxide should not be breathed" inserted.

R. C. Jones,
Industrial Hygiene Branch,
Department of Industrial Relations,
Lidcombe, NSW.

Two antennas — two channel 10's:

I am a regular reader of your magazine and thought the following may be of interest to your readers.

Living in Zillmere, a northern suburb of Brisbane, I constructed a TV antenna for Channel 10 ("TV Antenna Design Data", "Radio, Television and Hobbies" May, 1962) to pick up Channel 10 Nambour, a translator (horizontally polarized) taken from SEQ 8 Maryborough. Even though the output power of this translator would assumably be relatively low, I was surprised with the quality of reception.

Also, realising there is a Channel 10 in Toowoomba (also horizontally polarized), I thought this channel would interfere with the Channel 10 from Nambour. However, on rotating the aerial toward Toowoomba, the Channel 10 from Toowoomba was received with amazing quality. The rotation angle between each Channel 10 is 90°, hence, I conclude this is the reason for no cross interference between channels.

I have since constructed another Channel 10 antenna, and now have one directed towards Nambour (65km away) and the other to Toowoomba (Bunya Mountains 130km away) and now receive two different programs on the SAME channel, simply by switching from one antenna to the other.

Rex Garton,
Zillmere, Qld.

Books & Literature

Radio handbook

RADIO HANDBOOK. Twenty-second edition by William I. Orr, W6SAI. Published 1981 by Howard W. Sams & Co, Inc. Hard covers, 1200 pages, 234mm x 160mm. ISBN 0 672 21874 7. Price in Australia $39.95.

Any book that has been around for 47 years and that has reached its 22nd edition must have high reader appeal, and a perusal of the pages of the Radio Handbook indicated why this is so.

The book contains a huge amount of information, both theoretical and practical, for the radio amateur or prospective amateur.

The early chapters provide an introduction to amateur radio, DC and AC theory, active devices (both semiconductor and valve) and their use in special circuitry.

From there the subjects covered are all that one would expect in a text book for amateur radio: AM, FM and SSB; The design and construction of receivers and transmitters for the HF and VHF bands; Radiation and propagation; Antennas; Mobile equipment; Specialised communications systems and techniques; Test equipment and so on.

The text is well written and the illustrations, both photographic and line drawings, are clear and well reproduced.

Although primarily intended for radio amateurs, the Radio Handbook would also be of use to other readers interested in radio communications.

Our copy came from McGill's Authorised Newsagency Pty Ltd, 187-193 Elizabeth Street, Melbourne, Vic 3000. (R.F.)

ZX81 programming

"THE ART OF PROGRAMMING THE 1K ZX81" by M. James and S. M. Gee. Soft covers, 86 pages, 110 x 170mm. Published by Bernard Babani Ltd 1982. ISBN 0 85934 084 8. Price $5.85.

This book is intended for ZX81 users who, having read the Sinclair manual, find that they are still not able to formulate their own programs. It is assumed that the reader has some knowledge of BASIC, although the meaning of many functions are reviewed for those who are less than proficient in this respect.

Presented in a readable style, the book acknowledges that programming the ZX81 can be daunting for the newcomer – especially within the constraints of the 1K memory. Almost all of the programs presented are for games, the premise being that the Sinclair manual provides an explanation of many calculation routines. Additionally games are an "enjoyable medium for learning" and more serious programs, such as business or household management will not fit into the 1K of memory. Some of the games include Lunar Lander, Hangman and Cannon-ball.

Although the operation of most of the routines are explained, this is only a small book and does not dwell on any subject at any length. Consequently, some explanations are not particularly detailed. Chapters are included on Randomness, Graphics and Moving Graphics. The final chapter is entitled "Hints and Tips", and in the interest of making the most of the limited memory it discusses various space saving techniques. For most users, this may well prove the most useful aspect of the book. In summary, a handy book for frustrated ZX81 users – particularly those with a preference for games. (C.D.)

Computer design

MICROCOMPUTER DESIGN AND TROUBLESHOOTING: by Eugene M. Zumchak. Soft covers, 347 pages, 135mm x 226mm, illustrated with diagrams. Published by Howard W. Sams & Co Inc 1982. ISBN 0 672 21819 4, Price $26.75.

This book is part of the Blacksburg Continuing Education Series, and lives up to the generally good reputation of that range. In seven lengthy chapters the author covers suitable microprocessors in controller functions, development systems, interfacing to commonly used memory chips, hardware design and testing, troubleshooting procedures and software design.

The book's great strength is in hardware. Unlike other publications this one considers different "families" of microprocessors, chiefly the 8085 and the 6502. It gives full details of interfacing techniques including parallel and serial ports, the S-100 bus and the IEEE-448 interface.

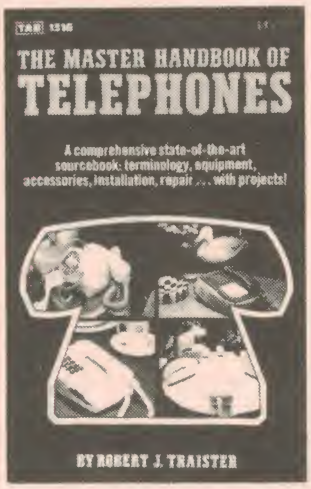
The often vexatious question of using devices from different families together is fully covered, and the text is well-supported with diagrams and circuits of typical microprocessor equipment. The sections on EPROM programming will be particularly valuable to the home constructor.

Software design is less fully covered, and in general terms only. Documentation, design philosophy and techniques are given passing consideration.

The only fault with this book is that it does not make any mention of the increasingly popular SS-50 bus. Many will also consider it expensive, too, for a soft cover publication.

Our review copy came from McGills Authorised Newsagency Pty Ltd, 187-193 Elizabeth St, Melbourne, Vic 3000. (P.V.)

Telephone manual



THE MASTER HANDBOOK OF TELEPHONES, by Robert J. Traister. Published 1981 by Tab Books Inc, Blue Ridge Summit, Philadelphia. Soft covers, 210 x 121mm, 357 pages, illustrated with many photographs. ISBN 0 8306 1316 1. Price $17.50.

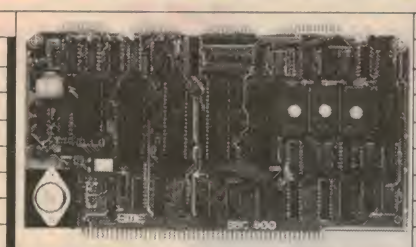
This is a comprehensive survey of the domestic telephone scene in the USA. A myriad of telephones are described and discussed, as well as telephone answering devices and accessories such as amplifiers, silencers, extension ringers and wireless telephones.

However while it may be of great interest to readers in the USA the book is completely irrelevant to Australia. And wonder of wonders, here is a book about telephones with not one telephone circuit, apart from the odd amplifier schematic from Radio Shack.

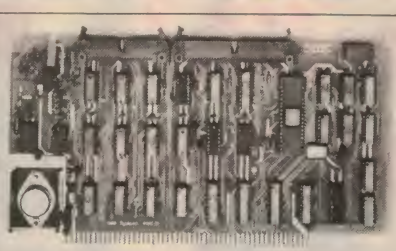
Our copy came from McGills Authorised Newsagency, Melbourne. (L.D.S.)

(continued on page 103)

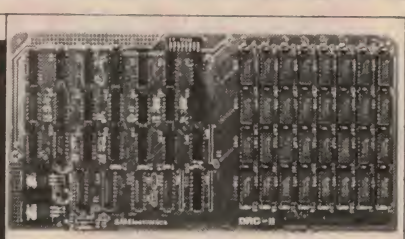
K-NAR COMPUTER CARDS
S100 Z80 SYSTEM CARD SPECIALISTS



SBC-800



FDC-II



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You know the SME Systems boards as the most powerful and technically up-to-the-minute manufactured in Australia today.

Using K-NAR's mail order system can save you dollars. Compare our prices on these high performance cards.

SBC-800

4Mhz Z-80 CPU, two serial RS232 ports, software programmable Baud rate gen., Centronics parallel port, 22 prog. I/O lines, real time clock (battery backed), 2K CMOS RAM, power on reset/power fail detect, battery backed as standard, etc. List Price $495. Our Price $395.

SBC-400

4Mhz Z-80 CPU, 1K Static Ram, RS232 I/O with Sync/Async, Centronics interface, 4Ch. counter/timer, Soft. Prog. Baud rate generator, 2K CP/M BIOS EPROM option. List Price $395. Our Price $315.

FDC-II

Enhanced floppy disk controller, IBM 3740 compatible, operates 5 & 8" and single/d. density drives, handles up to 4 drives, runs multi-density CP/M2.2 & MP/M 2. Vectored interrupt operation optional. List Price $465. Our Price $370.

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The board for multi-user installations. 64/256K dynamic RAM card, bank select, fast 4Mhz operation, on-board memory prom, dip-switch selectable boundaries, bank mode allows up to 8 boards on bus, hidden refresh, phantom disable. List Price $600. Our Price $475.

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Fool-proof memory system. State-of-the-art CMOS memory card with memory protection. on board battery back-up, compatible with DRC-II, write protection enable/disable, can be used as complete EPROM card or any combinaation of EPROM or CMOS ram. List Price $525. Our Price $420.

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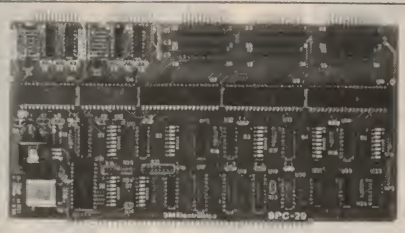
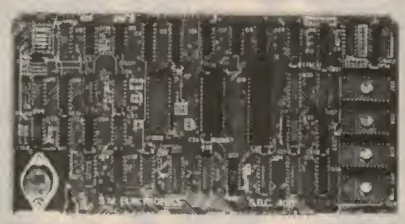
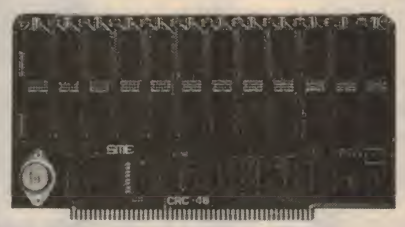
The low cost alternative to stand-alone terminal. Flexible 80x24 memory mapped video display board with full ASCII, semi graphics, Inverse & half intensity video, flicker free screen updating. Battery backed option offers diagnosis of system shut downs. List Price $325. Our Price $265.



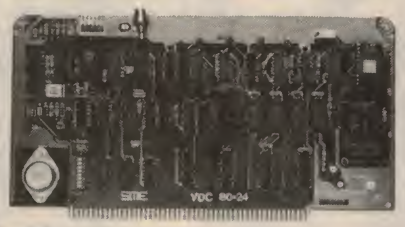
SPC-29



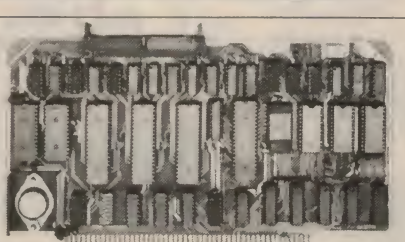
SBC-400



CRC-48



VDC-8024



MPC-6 DARTBAUD

MPC-6 DARTBAUD

For Multi-user systems. Multi-channel RS232 Intelligent I/O card with full I/O buffering and high level input/output drivers. 6 channels, on-board Z80 processor, software programmable baudrates, 6K buffer memory (battery backed). User programmable features for system tailoring. List Price $725. Our Price $575.

SPC-29

High performance dual serial & 9 parallel port I/O CARD, with full I/O address decoding. Switch selectable baud rates. Link patch area, programmable modes for strobed/latched I/O. List Price $295. Our Price $235.

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Name
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Signature

Please include me on your new product mailing list. I am mainly interested in systems for ☐ Hobby, ☐ Industrial use ☐ Education ☐ Business ☐ Process control ☐ Other

PEN 220

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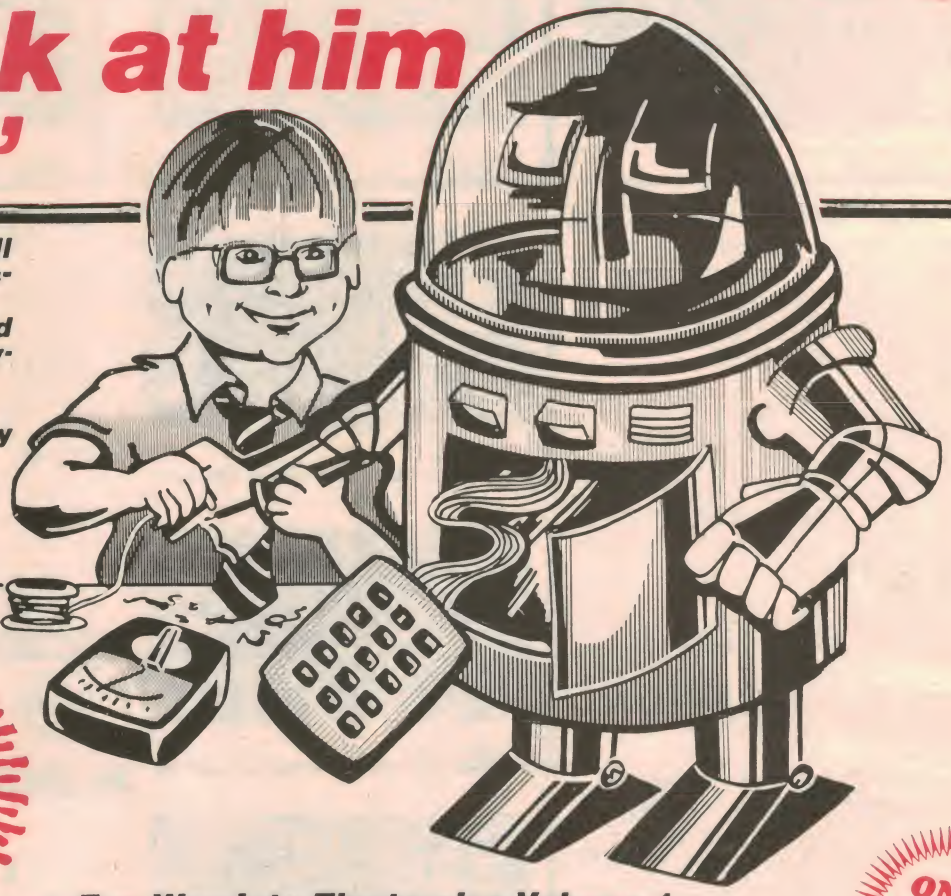

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Books Ctd from P100

Aerial projects

AERIAL PROJECTS, by R. A. Penfold. Published 1982 by Bernard Babani Ltd, London UK. Soft covers, 178 x 113mm. 84 pages, illustrated with circuits and diagrams. ISBN 0 85934 080 5. Price $5.85.

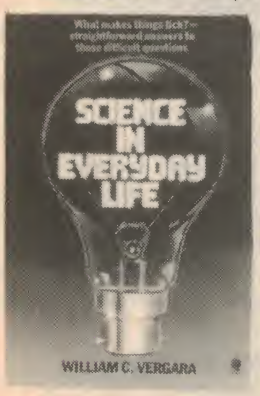
Shortwave listeners are the main target of this small book. The author considers some practical aerial designs such as long wire, dipoles and ground plane aerials. Active, loop and ferrite rod aerial designs are also presented and these are easy to build.

The third and last chapter in the book presents some designs for aerial accessories such as a HF Band Preselector, Variable Attenuator, Tunable Notch Filter and an Aerial Tuning Unit.

In short, an inexpensive text of interest to the shortwave listener. Our copy came from the Technical Book & Magazine Company, Pty Ltd, Melbourne. (L.D.S.)

Everyday science

SCIENCE IN EVERYDAY LIFE, by W. C. Vergara. Published 1982 by Sphere Books Ltd, London. Soft covers, 197 x 130mm, 306 pages, ISBN 0 7221 8720 3. Distributed in Australia by Thomas Nelson Australia, 480 La Trobe St, Melbourne. Price $6.95.



"Science in Everyday Life" could generally be regarded as being written in popular vein. A more caustic view is that it is written for scat-brained televiewers who have a concentration span of less than five minutes. It is really quite useless and consists a long string of items of about a page or so headed by rivetting questions such as "Why does bread go mouldy"? or "Do ants build roads".

Even if one regarded such a mine of trivia as being useful, it is not readily accessible. While there is an index of sorts, there is no list of contents, no chapter headings and no general theme.

Help save trees. Leave this book on the retail shelves. (LDS).

Shortwave Scene

by Arthur Cushen, MBE

Shortwave Scene celebrates 30 years publication

Over the past 30 years this column has presented news for shortwave listeners, covering a wide variety of subjects as the world of radio listening progressed from the valve radio to the transistorised digital read-out receiver of today.

In October, 1952 the writer took over this column from Ray Simpson. At the same time other listeners were featuring in the magazine including Ted Tinning with "Broadcast Band News", while Australian "Radio World" had a feature by Les Keast and the Australian DX Club publication "Skyrider" was being edited by Graeme Hutchins.

In the October 1952 issue the lead story covered the new international service of Radiodifusion National Belge and published a conversion chart from metres to kilocycles. The only transmission from Radio Nederland was broadcast from Holland in English at 0230UTC – reported in the page as 1.30pm AEST, and of course the frequencies were listed in kilocycles. The column was called "Short-wave Notes" and the magazine was then "Radio and Hobbies".

By October, 1962 the feature had been retitled "On Shortwave", and all times were being shown in GMT, while the name of the magazine was then "Radio Television & Hobbies". The lead story that month reported that Radio Canada had added a further 50kW transmitter to its shortwave services. Radio Japan had just introduced its General Service broadcasting hourly in English; and a reception report of TI4NRH in Costa Rica brought back memories of one of the first five shortwave stations in the world. The BBC General Overseas Service had just introduced "Shortwave Listeners' Corner".

Looking back 10 years to October, 1972 the feature was called "Listening around the World" and the name of the magazine was "Electronics Australia". The highlight of that month was the report that Radio Canada International was using 250kW transmitters at Sackville for its service to the South Pacific, as well as to most other areas in the world; Israel was reported as testing new transmitters to Europe, Sierra Leone was being heard on 3316kHz and Radio New Zealand had a special transmission to Antarctica.

In the first issue in October, 1952 a brief summary of the writer's listening achievements reported that he had 906 broadcast verifications and 1455 on shortwave. Now some 30 years later the broadcast verifications total 2544 and 5301 on shortwave, giving a total of 7845 verifications from 272 countries. Interest in radio listening has increased tremendously over the years, receivers have been designed to make locating stations as simple as dialling a telephone and the power of shortwave broadcasters has been increased to such an extent that though a reliable service cannot be guaranteed, listeners can generally find acceptable listening conditions at any time of the day and night.

WORLD COMMUNICATION YEAR

After four years of discussion within the United Nations, the UN General Assembly has finally decided that 1983 will be World Communication Year. The purpose is the development of communications, particularly to increase the scope and effectiveness of communications as a force for economic and social development. Activities will focus on national communication policies and implementations. The aim is to seek ways to use communication technology to promote the harmonious development of economic, social and cultural policies. The lead agency co-ordinating the World Communication Year 1983 is the International Telecommunication Union and information is available from WCY-83 Secretariat, Palace of Nations, CH1211, Geneva, Switzerland.

SOUTH AMERICAN NEWS

ECUADOR: Radio Dif del Ecuador Guayaquil on 4656kHz has been heard at 1015UTC with news in Spanish and at 1040UTC has the National Anthem and full station announcements with a network news bulletin carried at 1045YUC. Steven Greenyer and Owen Cullen, reporting in the NZ DX Times, state that Radio La Voz del Napo has been heard with weak signals on 3280kHz at 1045UTC. On 3380kHz Radio Iris opens at 1100 at good strength.

VENEZUELA: Radio Tachira, San Cristobal on 4830kHz has been heard before 10000UTC at good strength. On 4800kHz, Radio Lara opens at 10000UTC with a good signal while Radio Continente is also noted on 5030kHz at the same time.

ELBC MONROVIA

The long established Liberian Broadcasting Corporation, operating from Monrovia, has been heard on 3255kHz at 0515UTC and at 0600 with English commercials and full staton identification. At 0700 the station carries a news bulletin in English, according to the NZ DX Times. Some information about the return of this station to shortwave broadcasting is given in Sweden Calling DXers which gives the slogan as Liberian Broadcasting System. After a break from 1980 the station returned to the air in 1982. The reason for the break in transmission was that the station was awaiting spare parts and some staff were being trained in the United States. Broadcasts on 3255kHz are at 0530-0900UTC and 1600-2400 and on 6090kHz at 0800-1730UTC.

INDONESIAN SIGNALS

Signals from Indonesian stations, particularly those outside the usual short wave bands are being well received at the moment. Two signals, RRI Biak, Irian Jaya on 5451 and RRI Pekanbaru on 5886 are being received as early as 0900UTC. Dene Lynneberg in the DX Times reports reception of these two signals in Indonesian. Another transmission from Irian Jaya is also being received from RRI Jayapura on 9613kHz which is also heard around 0900UTC and at 0915 has a local news bulletin and at 1000UTC relays news from Jakarta. RRI Medan has been noted on 3375 and 4764kHz with both frequencies closing at 1658UTC. RRI Surakarta using 4931kHz has been heard at 1140UTC with popular Indonesian music.

TURKISH FOR AUSTRALIA

After some months of inactivity the Voice of Turkey is again broadcasting to Australia in English and Turkish. The transmissions are on 17715kHz with English at 2200-2255UTC followed by Turkish to 0300UTC. At the same time a broadcast to North America in Turkish is carried on 11900kHz. The 100kW transmitter on 17715kHz has recently been rebuilt for this transmission.

NEW CLUB FORMED

A new club "DXers Australia" has been formed in eastern Australia with headquarters in Melbourne. The new group is publishing a magazine titled "Dxers Calling" with Sam Dellit of Melbourne as Editor. Chris Martin of Sydney is editing the mediumwave section, Ray Crawford of Gladstone, Queensland, verification information, Harry Weatherley of Melbourne, Shortwave News, and Geoff Cosier of Melbourne will be covering international news. The club is seeking membership in the South Pacific Association of Radio Clubs. The address of "Dxers Australia" is PO Box 80, Forest Hill, 3131 Victoria.

FRANCE BEAMS TO LATIN AMERICA

As indicated in the August issue, Radio France International is expanding its programs and this month commenced a service to Latin America. The broadcasts are from 2200-0200UTC in French, Spanish and Brazilian Portuguese from transmitters in France at Allouis and Issoudun.

From January 1984 with the opening of four transmitters at the relay base in Monsinery, French Guyana, RFI will be able to cover the whole of Latin America and will broadcast a 21-hour daily service in French, Spanish and Brazilian.

The target area of the relay base will be the Antilles, the Caribbean, Central America and the east and north coasts of South America, according to a BBC Monitoring Service report.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time, add a further hour.

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BLANK PC BOARD $49

USES 2708's!

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

OUR 450 NS 2708'S ARE $5.90EA. WITH PURCHASE OF KIT

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32K S-100 EPROM CARD

NEW!

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KIT FEATURES

1. Uses +5V only 2716 (2Kx8) EPROM's
2. Allows up to 32K of software on line!
3. IEEE S-100 Compatible
4. Addressable as two independent 16K blocks
5. Cromemco extended or Northstar bank select
6. On board wait state circuitry if needed
7. Any or all EPROM locations can be disabled
8. Double sided PC board solder-masked silk screened
9. Gold plated contact fingers
10. Unselected EPROM's automatically powered down for low power
11. Fully buffered and bypassed
12. Easy and quick to assemble

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16K Dynamic RAM Board assembled and tested. Special $269 plus tax (4mHz). $299 plus tax (4mHz). This must be the best offer available on quality tested dynamic RAM boards.

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A&T $219

KIT FEATURES

1. Addressable as four separate 4K Blocks
2. ON BOARD BANK SELECT circuitry (Compatible with Standard Addressing as 16K on one)
3. Uses 2114 (450NS) 4K Static Rams
4. ON BOARD SELECTABLE WAIT STATES
5. Double sided PC Board with single mask and silk screened layout. Gold plated contact fingers
6. All address and data lines fully buffered
7. Extra sockets ALL parts and sockets
8. PHANTOM is jumpered on PIN 67
9. LOW POWER Under 1.5 amps TYPICAL from the +5 Volt Buss
10. Blank PC Board can be populated as any multiple of 4K

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W. SUPPORT IC'S & CAPS $29

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KIT FEATURES

1. Addressable on 16K Boundaries
2. Uses 2114 Static Ram
3. Runs at Full Speed
4. Double sided PC Board Solder mask and silk screened layout Gold fingers
5. All Parts and Sockets included
6. Low Power Under 1.5 Amps Typical

BLANK PC BOARD — $49 COMPLETE SOCKET SET — $22 SUPPORT IC'S AND CAPS — $45

NOW A $99 Computer!

Plugs into any TV!

ETI 660

No one would have believed it a few years ago! Features include: colour capability, operates from optional 9V plugpack, 1K memory expandable to 3K on board, single board construction, cassette interface, audio output (play tunes), simple to program (uses Chip-8). Expansion projects coming up include: ASCII keyboard, light pen, games software etc. (So we are told).

Starter Kit (1K RAM, B&W video)	$99.00
9V 200mA plugpack to suit	$12.50
Colour video option	$16.00
RAM EXPANSION (add to PCB)	$9.00

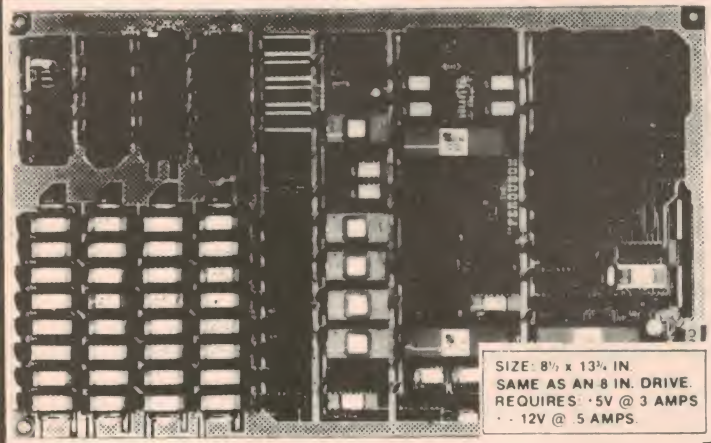
As with all new kits, please phone first to check stocks. We expect the kit to be in stock some time in Oct. 1981.

ETI636 7 SLOT MOTHERBOARD WITH ACTIVE TERMINATION

Kit of Parts $89.00. Assembled and tested $115.00, inc tax

RITRON COMPUTER GRADE POWER SUPPLY +5V Reg. 10A, ± 16V Unreg. Kit of parts $89.90 inc tax A&T $109.00 inc tax

Write for list of other power supplies. Tax free prices also available



SIZE: 8½ x 13¾ IN. SAME AS AN 8 IN. DRIVE. REQUIRES: +5V @ 3 AMPS, -12V @ .5 AMPS.

SINGLE BOARD COMPUTER KIT

NOW ONLY $499 + TAX (17½%)

Also available, Blank PCB's with Roms

Assembled & Tested $599 + TAX

THE FERGUSON PROJECT: Three years in the works, and maybe too good to be true. A tribute to hard headed, no compromise, high performance, American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, and an enclosure, and you have a total Business System for about 1/3 the cost you might expect to pay.

FEATURES: (Remember, all this on one board!)

64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user. our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true.

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: $65

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2.

BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

FOUR PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $29

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts $19

PFM 3.0 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided. It does not occupy any of the 64K of system RAM!

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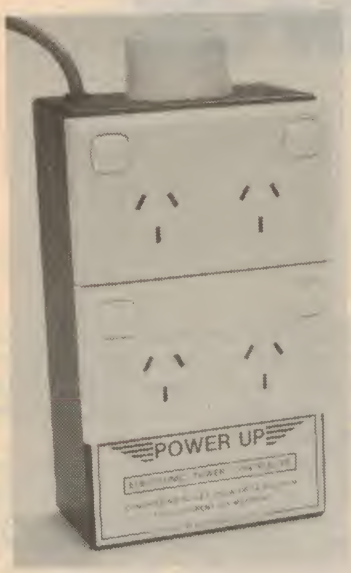


Power Controller

Called the "Power Up", this clever gadget will automatically switch on all your hifi gear whenever one item, plugged into a controlling outlet, is switched on. Build it and forget about manipulating all these separate on/off switches.

TV Distribution Systems

Held over from last month, this article describes how to provide multiple outlets for TV antennas and VCRs. It's easy – when you know how!

TI-99/4A colour computer

Texas Instruments' new TI-994A colour computer should prove a hot competitor in the under $500 home computer market. Don't miss our in-depth review in next month's issue.

ON SALE:
Wednesday, November 3rd

* Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.

From design to printed circuit:

Prototyping boards make life easy

Just how does the modern experimenter go about developing an experimental circuit? How do we here, at Electronics Australia, set about converting somebody's brainwave into a working electronic circuit? With the complexity of modern circuitry, many of the time honoured methods are no longer appropriate, having been replaced by quicker and easier methods.

Once upon a time, in the days of simple circuits – well, relatively – and discrete components (valves even!) mocking up an experimental circuit was comparatively easy. One simply strung the various components together by soldering their terminals to convenient lengths of wire, sometimes involving four or five connections to one terminal, or even a "mid-air" junction.

The result was never a thing of beauty; in fact, it was commonly referred to as a "bird's nest", or even a "rat's nest" if one wanted to be particularly disparaging. But appearance wasn't the point; the point was to prove the validity of the circuit concept or, if it didn't work, to change it until it did.

Unfortunately, making changes was not always that easy. With four or five leads it was always the one buried deepest in the solder which needed to be changed, with the result that the whole junction flew apart and had to be re-made. A messy process at best.

Worse still was one's tentative attempt to add just one more wire to a mid-air junction already terminating four or five leads. With care, it was possible to apply just enough heat to melt a tiny area of solder and tack on the new lead without disturbing the existing junction. But if one applied too much heat ... splat; solder and leads flew in all directions.

Even so, it wasn't too bad while components were relatively large and had only a few connections to them. But as they became smaller, and ICs appeared with centipede-like leg assemblies, the old soldering approach became impractical. Try soldering four or five leads to a single IC leg and see how you get on. Worse still, try changing one of the connections to modify the circuit and you'll find yourself in real trouble. And, apart from anything else, it takes time to make soldered connections, even if everything doesn't fly apart.

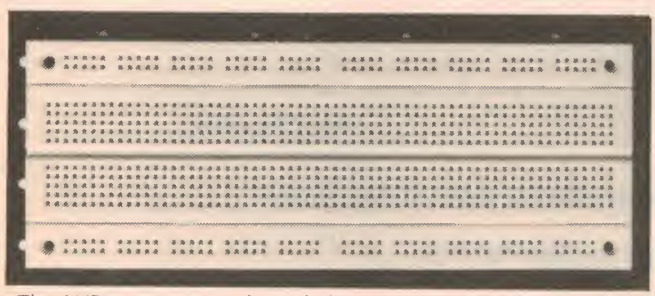
So what's the answer? Well, we still build bird's nests, but much more scientifically. They are not much prettier to look at, but they are a whole lot easier to build and, more importantly, to modify when the original idea doesn't work as expected.

The modern approach is to use some form of prototype board of which there are several sizes available, in several brands. And if you don't know what a prototype board is – well that's why we are writing this article. Some idea of what it looks like can be gleaned from the photographs, and we will try to fill you in on the mechanical details and how to use it.

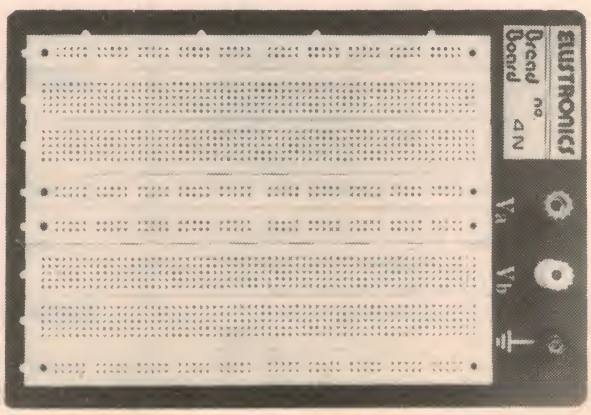
As can be seen from the photograph, a typical board assembly may consist of three separate boards; a narrow board top and bottom, with a larger board in between. The narrow boards have two horizontal rows of holes, in groups of five, and the large board has two rows of holes in vertical groups of five, with a gutter between them.

Each hole is, in fact, a precision socket with nickel plated contacts designed to accept typical component pigtails between 0.3 and 0.8mm diameter (22 to 30SWG), or IC legs. And in the latter regard the sockets are spaced to match the standard 0.1in separation for IC pins.

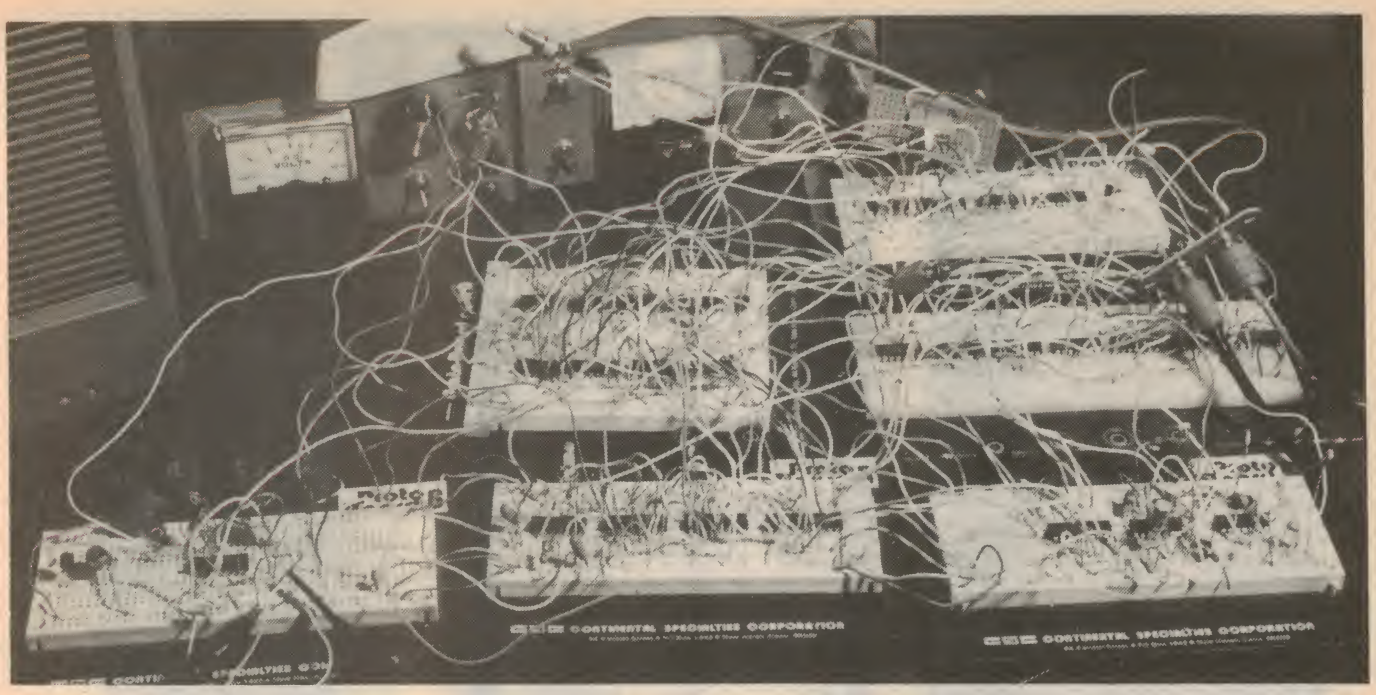
But the most important aspect of these sockets is that they are connected together in convenient groups, thus pro-



The WB-1 prototype board shown above can accommodate seven 14-pin ICs. Price is $17.40 from Ellistronics Pty Ltd.



The model 4N provides twice the area, baseplate and terminals, for less than twice the price – $27.60. ►



"Rats nest": working prototype of our Large screen Storage CRO Adapter (EA, February 1982).

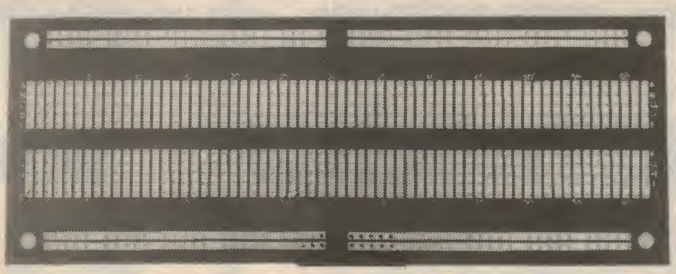
viding the means to connect several leads or pigtails together with no more effort than pushing them into the appropriate sockets. In the case of the main board each vertical group of five holes is connected together and, in the two narrow boads, the connections are made horizontally, both within the groups of five and between them.

However, each of the two runs in these boards is separate from the run above or below it, and each run is broken at the centre. These runs are usually used as supply rails and the break in the centre may be used to insert de-coupling components, such as resistors or chokes.

Typically, the bulk of the circuit would be built on the large, main board, with the ICs fitted horizontally, straddling the gutter. In the case of the board illustrated, some seven, 14 pin, ICs could be accommodated along the gutter, which would imply a fairly complex circuit.

And once the IC is fitted across the gutter, each leg has four vacant contacts connected to it, making it a simple matter to connect this number of leads to it. In practice, many more than four connections can be made to any one point, as more groups of holes are brought into use to accommodate individual components.

Interconnecting leads are best made from single strand plastic insulated wire – not stranded hookup wire – within the guage limits already mentioned. An excellent source of such wire is an odd length of multicore telephone cable, such as two-pair (four conductors), six-pair (12 conductors), or larger if you can get it. The larger groups have the advantage of a larger range of colours. Short lengths are available from component retailers, or you may be able to cadge some from your friendly Telecom technician.



For prototypes that may come in for rough handling, these printed boards offer convenience and ruggedness.

The board we have used for illustration is about the minimum configuration needed for serious experimental work, but larger versions are available. A double arrangement of this board is a popular size, and is available mounted on a metal ground plane, to provide a measure of shielding, and fitted with power supply terminals. And, if this isn't big enough, several boards can be used.

As we implied earlier, this is the system we now use, almost exclusively, in the EA workshop, to convert someone's pencilled circuit into a working prototype. Not only is it quick and easy to set up, but equally easy to modify. And make no mistake, few circuits work exactly as intended first time; they usually need many hours work to achieve the desired result.

What is usually regarded as our biggest "bird's nest" was that created in developing the Large Screen Storage CRO Adapter, described in the February 1982 issue (File No 7/C/35). This involved no less than six prototype boards, 40 ICs, and a host of resistors, capacitors, and other minor components. It looked horrible, but it worked, and was subsequently built up on the printed board we presented to our readers.

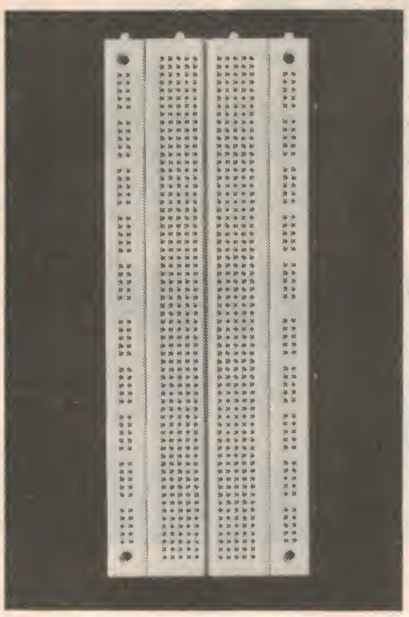
There are a number of variables in the actual prototype board hardware available. Some brands offer gold plated contacts as an option over the nickel plated variety, and some offer different terminal arrangements on the metal ground plane.

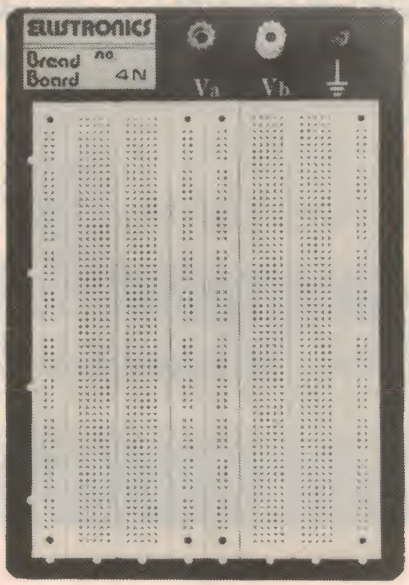
There are also printed board versions, and the one illustrated is identical in size, and uses the same "circuit", as the board already described. The main purpose of this version appears to be as an intermediate prototype between the bird's nest and the final printed board.

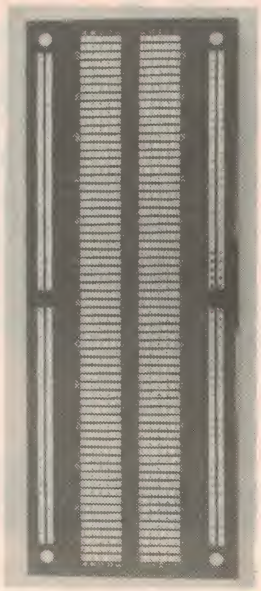
Such an intermediate stage is not usually necessary, but may be desirable where a prototype needs to be extensively field tested. A bird's nest may be good enough to evaluate performance on the bench, but would hardly stand up to rough handling likely to be encountered away from the workshop.

So there it is. If you are a serious experimenter, but haven't tried the prototype board yet, you are in for a pleasant surprise. Our bet is that you will try your hand at a lot more circuits, and a lot more variations, when you find just how easy it is to try them out this way.

EXPERIMENTER KIT







SPECIAL PRICE IN CONJUNCTION WITH ELECTRONICS AUSTRALIA COMPETITION — $11.75

ELLISTRONICS SOLDERLESS BREADBOARD

Designed around two interlocking modular units, the WBDN is a distribution strip for power etc. and contains 100 contacts grouped in clusters of five. The WBTN is the terminal strip containing 640 contacts in two separate rows of five interconnected contacts each separated by a .300" median. Contacts are made from non-corrosive nickel silver alloy and are reliable for more than 10,000 insertions. The boards accept all DIP size including RTL, TTL, DTL, CMOS and most passive devices and interconnect with 20 to 29 awg solid wire. All boards are interlocking and elements are mounted on ground plane. Ideal for H.F., High Speed, Low Noise application.

		RETAIL PRICE
WBDN	Distribution Strip	$1.80
WBTN	Terminal Strip	6.80
WB2N1	1 Distribution + 1 Terminal Strip	8.35
WB2N	2 Distribution + 1 Terminal Strip	10.30
WB2NB*	2 Distribution + 1 Terminal Strip	14.50
WB4N3*	1 Distribution + 2 Terminal Strips	17.00
WB4N1*	3 Distribution + 2 Terminal Strips	20.50
WB4N*	4 Distribution + 2 Terminal Strips	23.00
WB6N*	5 Distribution + 3 Terminal Strips	31.50
WB8N*	7 Distribution + 4 Terminal Strips	44.50
WB16N*	10 Distribution + 8 Terminal Strips	83.50
WB24N*	20 Distribution + 12 Terminal Strips	126.50
Experimenter Board	A drilled and etched circuit board to match WB2N	1.60

*WB2NB thru to WB24N are mounted on an aluminium base plate complete with non scratch rubber feet and appropriate binding posts.

Available from: **VICTORIA:** Rod Irving (03) 489 7099 Kalex (03) 458 2976 Truscott Electronics (03) 723 3860 Billco (Project Electronics) (03) 791 8655 Ballarat Electronic Services (053) 359 584 **SOUTH AUSTRALIA:** Electronic Equipment (08) 212 5999 **WESTERN AUSTRALIA:** Altronics (09) 328 1599 Atkins Carlye (09) 277 0511 **NEW SOUTH WALES:** Electronic Developments (02) 438 2500 Jaycar (02) 264 6688 Bill Edge (02) 745 3077

ALL PRICES PLUS 20% SALES TAX

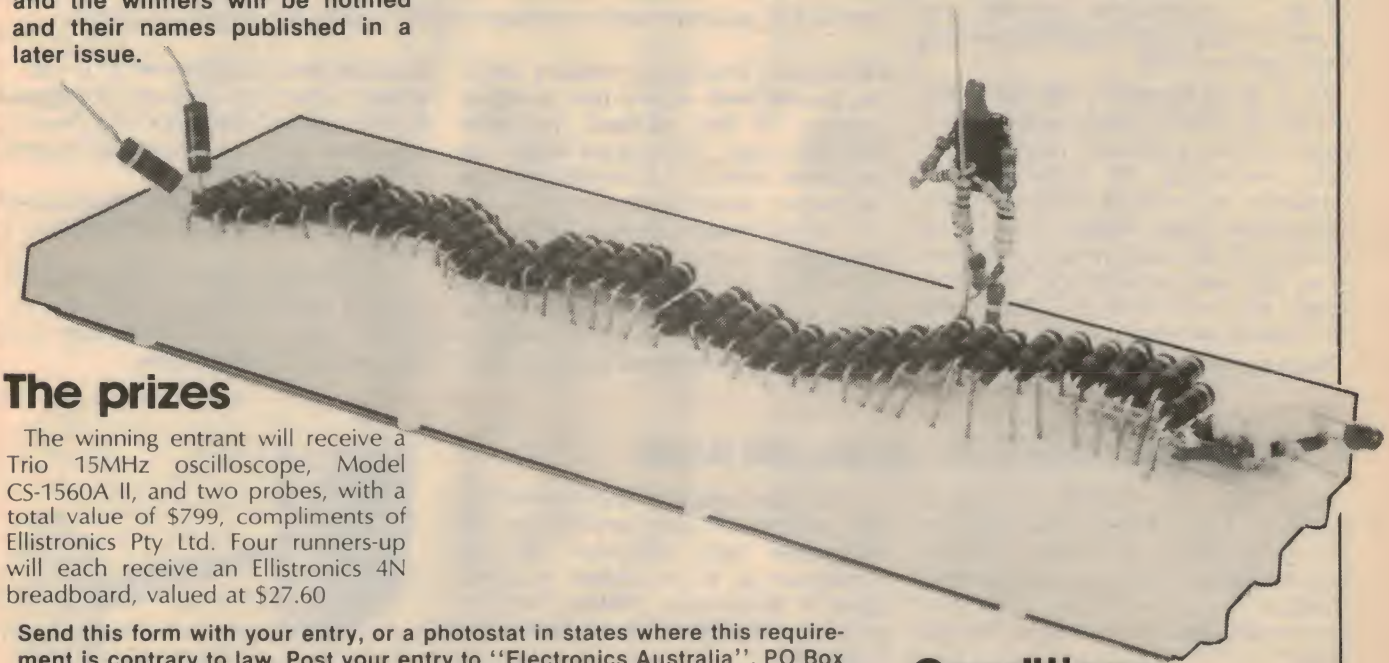
Win this CRO

EA/Ellistronics Sculpture Contest

"Electronics Australia" and Ellistronics are determined to put a little art into electronics. We are looking for the most artistic "creation" that can be produced on a prototype breadboard, using junk-box components — like our sculpture shown below, tentatively titled "Obe-wan Kenoble versus the Sandworm of Krakos".

Judging will be on the basis of a black and white photograph of your art-work — *don't* send us the actual work! We'll be looking at originality rather than the complexity of the design so there's no need to spend up big. Your entry must be on a breadboard though.

Entries will be judged by the editorial staff of "Electronics Australia" and chance plays no part in the competition. Entries will close on 31st December 1982 and the winners will be notified and their names published in a later issue.



The prizes

The winning entrant will receive a Trio 15MHz oscilloscope, Model CS-1560A II, and two probes, with a total value of $799, compliments of Ellistronics Pty Ltd. Four runners-up will each receive an Ellistronics 4N breadboard, valued at $27.60

Send this form with your entry, or a photostat in states where this requirement is contrary to law. Post your entry to "Electronics Australia", PO Box 163, Chippendale, NSW 2008. To arrive before 5pm, December 31, 1982.

NAME: . . . . . .

ADDRESS: . . . . . .

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Post Code . . . . . .

Conditions

The prizes are not redeemable for cash. The decision of the judges is final and no correspondence will be entered into. All entries become the property of "Electronics Australia".

Employees, and their immediate families, of Magazine Promotions Pty Ltd, John Fairfax and Sons Ltd or Ellistronics Pty Ltd and their associated advertising agencies are not eligible to enter the competition.

New Products...

Product reviews, releases & services

Two new calculators from Hewlett Packard

Hewlett-Packard has introduced two new programmable calculators, the HP-15C, and the HP-16C, designed for computer programmers and digital design engineers.

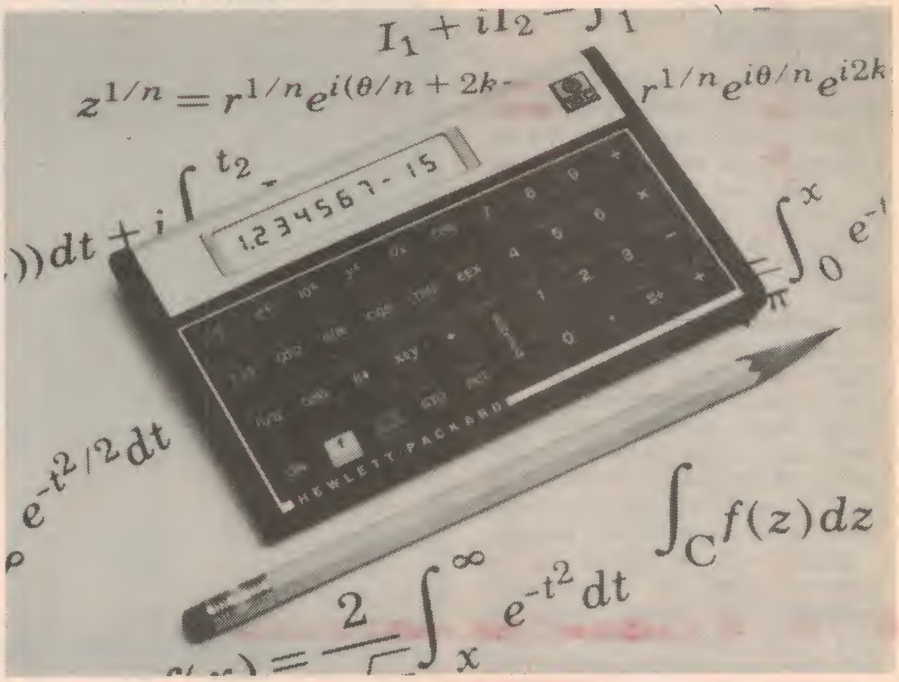
Both calculators feature a compact design with a liquid crystal display, low power consumption, continuous memory, and built-in self test. The new HP-15C has a wide range of built-in functions for maths, science, and engineering applications. Matrix and complex number operations, for example, are built-in.

Up to 64 matrix elements, distributed among five different matrices, can be stored in the calculator's memory. Other functions including arithmetic and exponential, logarithmic, and hyberbolic functions operate on complex or real numbers. Other features are an "integrate" function and conventional maths, scientific, and statistical operations on the one calculator.

The second new calculator, the HP-16C, is designed for computer programmers and design engineers working with digital circuitry.

As a programmable calculator the HP-16C can handle a wide range of computer science problems, including format conversions, bit extraction and simulation of selected microprocessor instructions. Since register size can be specified by the user up to a maximum of 64 bits, the calculator can be set to match the word size of virtually any commercial processor.

Programming features include up to 448 lines of continuous memory which can be allocated by the user as either program or data storage, five user-definable keys, 25 program labels, insert/delete editing, 12 conditional tests and indirect programming control.



The HP-15C programmable calculator offers an extensive range of functions.

An integer mode is provided for bit calculations. In this mode, numbers can be entered or converted in four different bases – hexadecimal, decimal, octal, and binary. Users can select whether numbers are interpreted as ones complement, twos complement or unsigned integers. Also provided are 18 different bit manipulation functions, four Boolean operators, and a conventional floating-point calculator mode.

The calculator can retain up to 203 program lines or 101 16-bit data registers in memory.

For more information contact Hewlett-Packard Australia Ltd, PO Box 36, Doncaster East, Vic 3109 or your local Hewlett-Packard distributor.

Arlec infrared alarms for shops and home

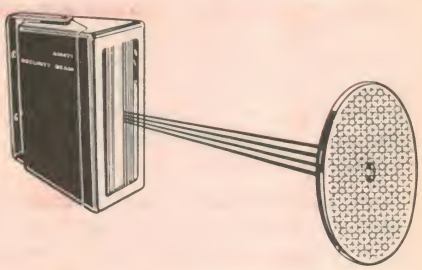
Arlec Pty Ltd recently announced details of a new item in their range or security products, the AM471 Security Beam; a compact infrared warning beam designed for use in shops, medical or factory reception areas, studios, and the home.

The security system consists of a solid state transmit and receive unit which projects a modulated beam of IR radiation across the passage way or area to be protected. A prismatic reflector opposite the transmitter reflects the beam to the receiver to complete the security circuit.

An interruption of the beam will trigger an alarm and sound an audible warning. The receiver is only sensitive to the modulated light produced by the transmitter so is unaffected by other types of illumination. Effective range of the system is adjustable between 0.5 and 8 metres.

Power for the unit is supplied from the mains via a 9V AC adapter. Installation is simplified because the transmitter and receiver is contained within one unit, allowing all wiring to be confined to one side of the secured area.

The AM471 is supplied complete with the transmit/receive unit, an adjustable mounting bracket, reflector, AC adapter,



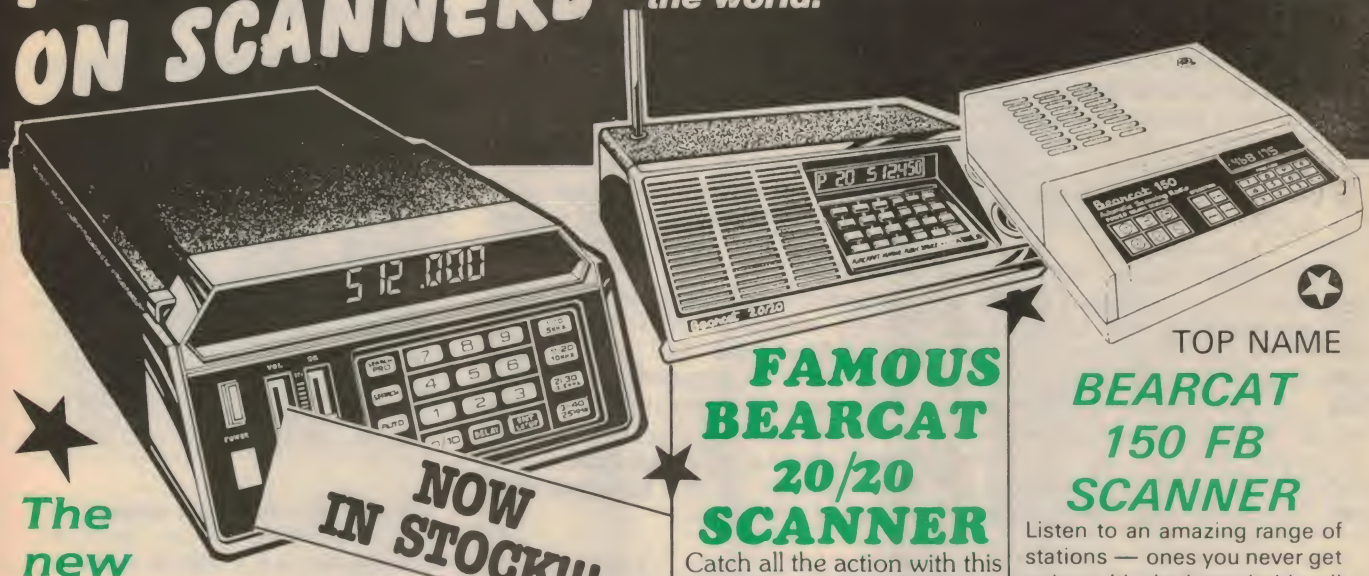
The Arlec infrared security system.

sound generator and 20m of connecting wire.

For more information contact Arlec Pty Ltd, 30 Lexton Rd, Box Hill, Vic 3128 (03) 840 1222.

SAVE A FORTUNE ON SCANNERS

Why pay $500 or more for a scanning receiver? Dick Smith has them from $285! Get into the exciting world of scanning – it's the latest and fastest growing hobby in the world!



The new DICK SMITH PRO 40 SCANNER

Compare with similar performance elsewhere at nearly twice the price! The new PRO 40 Scanner from Dick Smith represents the state-of-the-art in computerised scanning receivers!

★ Completely solid state computer-controlled circuitry — no expensive crystals to buy — complete with backup battery for stored frequencies.

★ Specially prepared Australian instruction manual (written and produced by our own engineers). Other scanners often have hard-to-understand foreign instruction manuals.

★ Touch-type splashproof keypad for direct entry of all operational commands, frequencies etc.

★ Ideal as either a base or mobile scanner (operates from 12V — beware of others that don't operate from 12V!) with its own self-contained whip antenna or external plug-in antenna.

★ Complete with mobile mounting bracket and DC power cable.

LOOK AT THESE SPECIFICATIONS:

Frequencies covered	68 to 88MHz — 136 to 174MHz — 360 to 512MHz.
Scanning steps	5, 10, 12.5, & 25kHz (depending on band)
No. of channels	40
Power supply	12 to 16 volts DC (battery memory backup 9V)
Scan rate	Approx 18/sec

Cat D-2805

AND LOOK AT OUR LOW, LOW PRICE

$399 $9.27 per week

FAMOUS BEARCAT 20/20 SCANNER

Catch all the action with this incredible receiver! It covers most of the VHF and UHF bands.

Listen to ...

Aircraft, amateurs, pagers, business radio, marine and harbour, UHF CB, taxis and more. Cat D-2810.

ONLY **$485** $11.27 per week

TOP NAME

BEARCAT 150 FB SCANNER

Listen to an amazing range of stations — ones you never get to hear. It's the latest hobby all over the world,and it's now in Australia.

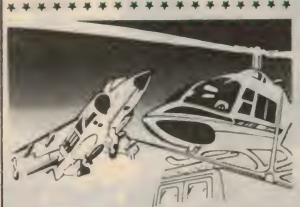
You can hear ...

Fascinating broadcasts, emergency services, taxis, ambulances, security patrols, aircraft, satellites and more.

Cat D-2800 **$285** $6.62 per week

EXCLUSIVE TO DICK SMITH

$12.95 *Dick Smith's Australian Radio Frequency Handbook*



Now available . . . for the first time in Australia, up-to-date and thorough listing of virtually all the VHF/UHF radio users we've been able to find. Yes — find out who is where — and where to listen for all the excitement! Plus much more information besides — air band, marine band, how to use a scanner, amateur radio and CB, etc. It's a MUST for anyone interested in radio or electronics. Where else can you get this sort of information?

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HORNET II 40 ch AM/SSB

The latest in 40 channel CB technology. The quality of this unit is even better than the high standard set by its predecessor, the Hornet I, our most popular CB ever!

ONLY **$239.50**

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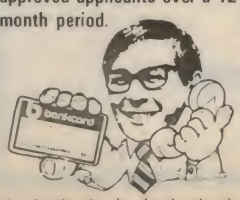
Terms offered above are to approved applicants over a 12 month period.



DICK SMITH HAM SHACK

The stores below stock this complete list of Dick Smith Amateur Radio equipment. All other Dick Smith stores stock some amateur equipment but may not be able to give you the service of 'Ham Shack' stores listed.

Sydney 125 York St. 290 3377 ● **Sydney** 6 Bridge St. 27 5051 ● **Gore Hill** 162 Pacific Hwy 439 5311 ● **Melbourne** 399 Lonsdale St. 67 9834 ● **Springvale** cnr Springvale & Dandenong Rds. 547 0522 ● **Richmond** 656 Bridge Rd. 428 1614 ● **Buranda** 166 Logan Rd. 391 6233 ● **Chermside** 842 Gympie Rd. 59 6255 ● **Perth** 414 William St. 328 6944

DSE/A325M/LM

New Products

Maintenance free industrial batteries

Chloride Batteries Australia has announced the release of a maintenance-free series of industrial batteries, the Exide RE Systems Battery Series. Based on the recombination electrolyte principle, the batteries are completely sealed, and offer a number of advantages to the user. (Refer. "A True Maintenance Free Battery", EA, January 1982.)

Chloride claim that after the battery is discharged to zero potential (usually a disastrous accident) it will recharge with little or no loss of capacity. It is also highly tolerant of overcharging, and will hold a charge in storage for 18 months or more at 25°C ambient temperature.

Claimed life is up to 1200 charge/discharge cycles and five to six years float service life. The one battery can thus provide both standby and charge/discharge cycling duty.

The new series batteries are completely sealed, releasing neither gas or acid. There is no need for "topping up" – in fact there is no way into the battery at all.

Electrolyte is held in close contact with the plates by absorbent separators of specially produced felted fibreglass so there is no free electrolyte in the battery. This last feature has won the Exide RE series approval by the Department of Transport for carriage on aircraft – an important factor for makers and users of battery powered equipment such as wheelchairs.

Batteries of the RE Series range from 6V models providing from 1.2 to 10 ampere-hours and 12V models with from 1.2 to 24 ampere-hours storage. Additional models are in development.

For more information contact Chloride Branch offices in all capital cities or the head office at 147-149 Woodpark Rd, Smithfield, NSW 2164.

Just part of the range of Exide maintenance-free industrial batteries.

Applicator for thermoplastic adhesives

The Homelec Gluefix 2000 glue gun offers a convenient way of applying thermoplastic adhesives for hobbyists, servicemen, and home handymen.

The glue gun uses solid sticks of glue which are melted by an electrically heated nozzle as it is applied to the job. It is powered from a 100-240V supply and is double-insulated for safety.

Applications include tile fixing, carpentry and home repairs, hobbies, arts and crafts. It is one of the few methods of gluing plastics. Although recommended for use with ceramics it may be less useful here, as it is not possible to achieve an invisible join with the hot glue.

Apart from the strength of the bond created, advantages of the glue gun include mess-free application of precise amounts of glue and the speed with which a neat, professional job can be performed. Price is around $20, including four sticks of glue, with an eight piece pack of replacement glue sticks at $1.75.

The Homelec Gluefix 2000 is available from hardware stores in all states.

Spectrum Control RFI filters from Rifa

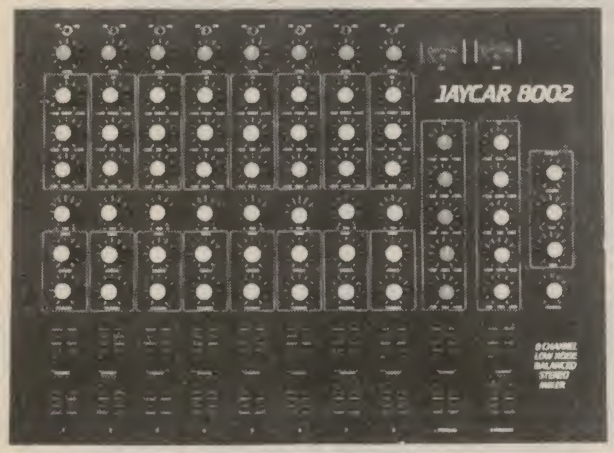
The Spectrum Control range of RFI filters is now available from Rifa Pty Ltd.

With the increasing awareness of the problems of radio frequency interference, these products should find a ready market. The Spectrum Control range includes hermetic seal filters and capacitors, connector contact filters, multi-circuit filters, knitted wire shielding gaskets, ventilation panels which provide shielding from interference and many other products designed to solve EMI problems.

For more information on the Spectrum Control range contact Mr W. Scott, Rifa Pty Ltd, 202 Bell St, Preston, Vic. Phone (03) 480 1300.

JAYCAR QUALITY MEANS PERFORMANCE RESULTS

FROM $495



8 CHANNEL MIXER KIT

The Jaycar 8002 Mixer was originally conceived to be the successor to the very popular ETI414 Master Mixer. The 414 was basically configured as a 'stage' mixer and suffered from a number of severe technical limitations – notably poor signal-to-noise figures. Enormous advances in Audio IC's have occurred since the 414 was designed. Jaycar engineers have taken advantage of this. The incredibly low noise and distortion figures of the 8002 are a testimony to the sound basic design of the mixer coupled with the performance capability of these IC's. Whilst the 8002 is the ideal 8 channel compact stage mixer, other applications have been kept in mind.
AS A "STUDIO" MIXER. The prime requirement of a studio mixer is that it must be quiet – i.e. have good S/N. Due to the fact that the "miracle" 5534 IC's are used in the 8002 studio applications are entirely feasible. In addition to this, metal film resistors are used in critical signal areas.
AS A DISCO MIXER. The balanced input feature of the 8002 is not really necessary for disco use. This section can easily be bypassed with either a moving magnet (Dynamic Cartridge) preamp, or a moving coil preamp The sensible format of the 8002 and tremendous equalization facilities should make this mixer popular for disco use.

- Balanced (600 Ohm) Mic. Inputs/Line Inputs.
- Cannon Connectors included in the price.
- Bass, Mid & Treble Equalization on each Input.
- "Effects" (i.e. Echo etc.) capability.
- Foldback and Stereo Pan on ALL 8 Inputs.
- 60mm Slide Faders used throughout.
- 19" Rack Mount capability (or Console Mount).
- Professional Black Front Panel with Format borders & multi-coloured knobs to assist function identification.
- VU Metering.

Send SAE for full details + details on use as stage mixer

"BLACK MONOLITH"

ONLY $299

Once again, imitation is the sincerest form of flattery. The Black Monolith 5000 Mosfet Power Amp has the following EXCLUSIVE features:
- Beryllium Oxide (Space Age ceramic) TO-3 washers. (Not flimsy mica)
- Jig drilled and extruded heavy gauge, anodised heatsink bracket.
- SUPERFINISH front panel. STILL THE BEST now with blind tapped holes.
- New heavy duty heatsinks for the driver transistors. 100% extra heatsink area and black anodised for greater efficiency. (Not in original design).
- Ventilation holes in metalwork at critical points. (Not in original design).
- Extra 3 pin DIN socket on rear panel (total 2) to power new 5000 components. (1/3rd Octave 5000 series Equaliser coming soon*). Not in original design but now a must with the new additions in the family.

IF YOU THINK THAT YOU CAN SAVE MONEY ON THESE KITS ASK YOUR SUPPLIER IF HE WILL GIVE YOU ALL OF THESE FEATURES AT THE PRICE. MAKE SURE THAT YOU GET IT IN WRITING!!
A PRICE RISE ON BOTH KITS (i.e. SALES TAX AND METALWORK ETC.) IS EXPECTED SOON!
BUY THE BEST FOR NO MORE.
Write in (SAE) for a new glossy leaflet on both amps.

SPECIFICATIONS

POWER OUTPUT	Around 100W RMS into 8 ohms
FREQUENCY RESPONSE	8Hz to 20kHz, +0 – 0,4dB 2,8Hz to 65kHz, +0 – 3dB Note: these figures are determined soley by passive filters
INPUT SENSITIVITY	1V RMS for 100W output
HUM	– 100dB below full output (flat)
NOISE	– 116dB below full output (flat, 20kHz bandwidth)
2nd HARMONIC DISTORTION	<0,001% at 1kHz (0,0007% on prototypes) at 100W output using a ±56V supply rated at 4A continuous <0,003% at 10kHz and 100W
3rd HARMONIC DISTORTION	<0,0003% for all frequencies less than 10kHz and all powers below clipping
TOTAL HARMONIC DISTORTION	Determined by 2nd harmonic distortion (see above)
INTERMODULATION DISTORTION	<0,003% at 100W (50Hz and 7kHz mixed 4:1)
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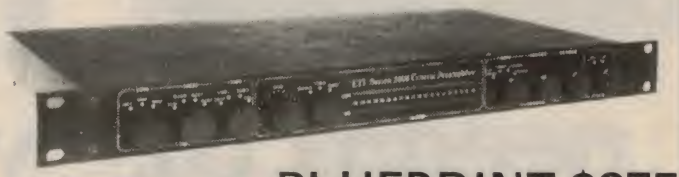

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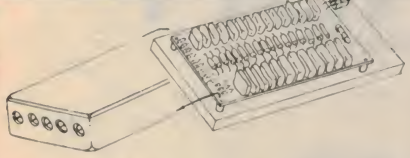
Frequency Response	High level input: 15Hz-130kHz, +0, –1dB Low level input: conforms to RIAA equalisation +0.2dB (see detail on Phono specs.)	
Distortion	1kHz 0,003% on all inputs (limit of resolution on measuring equipment due to noise limitation)	
S/N noise	High-level input, master full, with respect to 300mV input signal at full output (1,2V) 92dB flat, 100dB A weighted	
	MM input, master full, with respect to full output (1,2V) at 5mV input, 500 ohm source resistance connected 86dB flat 92dB A weighted	
	MC input, master full, with respect to full output (1,2V) and 290uV input signal 71dB flat, 75dB A weighted	

ETI-478MM Moving Magnet input stage	¼ 1kHz			
Gain	Conforms to RIAA Equalisation +0.2dB			
Frequency Response	0,001%, 1kHz, 10mV RMS input			
Total Harmonic Disorder	28dB with respect to 5mV RMS input signal, i.e 135mV RMS			
Headroom	Total equivalent input noise, 122nV 'A' input shorted, 216nV flat, input shorted			
Noise		1mV	5mV	10mV
	Flat	73dB	87dB	93dB
S/N ratio	A weighted	78dB	92dB	98dB
ETI-478MC Moving coil input stage	24			
Gain	7Hz – 135kHz +0, –1dB			
Frequency Response	0,003%, 1kHz, 30mV input			
Total Harmonic Disorder	Total equivalent input noise			
Noise	83nV flat, input shorted			
	42nV 'A', input shorted			
	56nV flat, after RIAA Eq. input shorted			
	34nV 'A' after RIAA Eq. input shorted			



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New Products

Wattmaster Alco digital time switch

Wattmaster Alco Pty Ltd has released a new model in its range of digital electronic time switches. The "Digital 2" from Wattmaster is said to be the first portable digital electronic time switch on the Australian market.

The unit is capable of 12 programmable switching instructions, which can be selected on a daily or weekly basis or for several days in succession. Using this last feature, switching instructions for a number of days can be entered without affecting memory capacity.

Portability is achieved by the use of an adapter plug which provides power for the switch unit as well as for the device being switched. Switching capacity is 10A at 240V.

The Digital 2 can operate attached equipment for any period from one minute to 24 hours, and is programmed in increments of one minute. It is said to be ideal for any application requiring accurate switching for up to one week in advance.

For further information contact Mr Jon Cronly, Wattmaster Alco Pty Ltd, 11 Rachel Close, Silverwater, NSW, 2141. Phone (02) 648 1332.

40-channel CB from Standard Components

Standard Components Pty Ltd has announced the release of the Electrophone Model TX470 UHF 40-channel transceiver.

Designed by Cybernet, Japan, the TX470 is said to be ideally suited for mobile installations such as in trucks and farm equipment. It has been extensively tested under field conditions.

The TX470 also makes provision for the fitting of Selcall or Quiet Line facilities, which allow only specially coded calls to be received.

A compatible command module, the GB590, is also available, providing a built-in power supply, front mounted loudspeaker and a clock.

For more information contact Standard Components, PO Box 174, Leichhardt, NSW, 2040.

Extruded aluminium instrument cases

A range of panel mounted instrument cases of extruded aluminium are now available from Amalgamated Instrument Co. Five sizes are available, with perspex or aluminium front panel inserts and internal slots for mounting circuit boards. More information is available from the company, PO Box 134, Terrey Hills, NSW 204 2084. Phone (02) 450 2661.

Altronics multimeters: special school offer

Altronics of Perth is giving away 200 of their popular Q1002 multimeters to high schools that offer electronics courses.

There is a limit of one multimeter per school, and Altronics intend that the multimeters be awarded as end of year prizes to outstanding students. Jack O'Donnell, manager of Altronics, stresses that the meters are completely free of charge to schools (Altronics will even pay the postage).

High schools which qualify for the offer should send a request on a school letterhead to Altronics, 105 Stirling St, Perth, WA 6000.

Portable impedance measuring unit

Sennheiser has released a new battery-powered impedance measurement unit, the ZP3. It is said to be ideal for use in situations where impedances must be measured frequently, either in the field or workshop. Applications include

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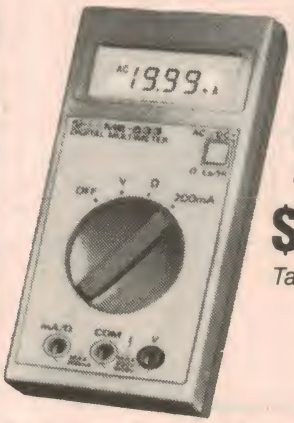

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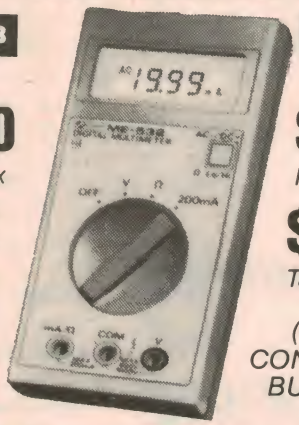

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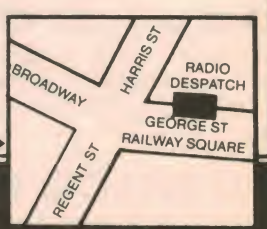

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measurement of loudspeakers, line transformers, deflection coils, and audio transformers.

The meter is fitted with six switchable measuring ranges from 20Ω to 2MΩ and displays impedance values on a large 3½-digit LCD readout. Indication of capacitive or inductive loads is provided and the meter can also be used for purely resistive measurements.

Maximum measurement error is said to be less than 5%, and the meter can be used to measure sensitive components such as recorder heads, sound, pick-ups, and microphones without risk of damage. Power is supplied from two 9V batteries.

For more information contact R. H. Cunningham Pty Ltd, PO Box 4533, Melbourne, Vic 3001 or PO Box 214, Neutral Bay Junction, NSW 2089.

Parameters to distribute Greenpar CRO probes

Parameters Pty Ltd has been appointed distributor for the Greenpar range of oscilloscope probes. Manufactured in England, the Greenpar range includes 1:1, 10:1, 1 and 100:1 fixed and switched attenuation types, covering the frequency range from 15MHz to 250MHz.

Cable length is 1.2m or 1.5m, and specially designed strain relief mouldings at each end add strength. Earth leads are attached with a screw fitting for easy removal.

For further information contact Parameters Pty Ltd, 41 Herbert St, Artarmon, NSW, 2064.

Transceivers, SWR meter from Imark

Imark Pty Ltd has released a repeater modification kit for the Sawtron 880 UHF CB transceiver. Repeater operation on UHF Citizens' Band is now permitted, and provides much greater coverage than normal simplex operation.

The Imark repeater kit when switched to repeater mode will automatically provide the repeater transmit offset for all eight permitted repeater channels. When an attempt is made to operate in the repeater mode on a simplex-only channel the transceiver will operate only in the simplex mode.

The kit is approved by the Department of Communications and is supplied complete with fitting instructions. Estimated installation time is 15 minutes from a competent technician. Price is $20, not including fitting.

Also from Imark is the Maldol HS450 Power and SWR Meter, covering the frequency range 130-500MHz and providing three power measuring ranges: 5W, 20W and 150W, with an accuracy of ±10%.

The HS450 is fitted with "N" type RF connectors, and insertion loss is said to be less than 0.5dB. The input impedance is 50Ω.

For further details of the repeater kit (Part number 904 905) or the HS450 contact Imark Pty Ltd, 167 Roden St, West Melbourne 3003. Phone (03) 329 5433.

Hand-held aviation band transceiver

A new phase locked loop synthesised frequency aeronautical band receiver has been introduced by Vicom International Pty Ltd. The hand-held receiver covers the VHF aeronautical band between 118 and 136MHz and offers 720 channels, selected by a digital thumbwheel switch.

Features of the receiver include an adjustable squelch level control and low power consumption (with up to six hours of continuous operation from rechargeable nicad batteries). Housed in a lightweight aluminium case, the unit is supplied complete with a flexible antenna, nicad battery pack, and an AC charger. It is said to be ideal for general avaiation use, local flying clubs, and gliding clubs.

More information is available from Vicom International Pty Ltd, 57 City Rd, South Melbourne, (03) 62 6931 or 339 Pacific Highway, Crows Nest, NSW, (02) 436 2766.

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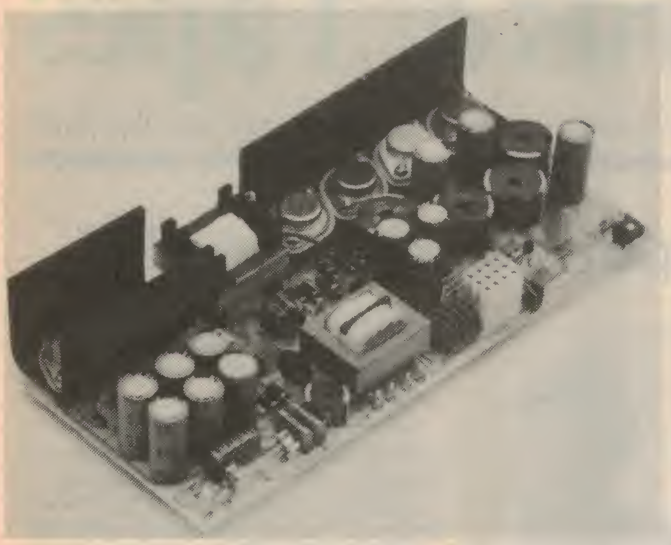
DICK SMITH Electronics

See page 98 for address details

New Products

Switch-mode power supply



Scientific Electronics, Australian designer and manufacturer of a wide range of power supplies, has released details of the SM130AD1, a highly efficient multi-rail switch mode power supply.

The SM130AD1 is available in two versions. The standard version provides four output rails of +5V at 15A, +12V at 4A, −12V at 2A and +24V at 2A. All outputs are protected against short circuits and the +5V and +12V outputs incorporate over voltage protection. An output signal is available to warn of a falling supply voltage, making the unit ideally suited for microprocessor based systems.

Equipment manufacturers can also order the power supply unit with voltage outputs according to their own specifications.

Other features of the power supply units are a claimed 70% efficiency at full load, 130W output, compact size and light weight. Each unit from Scientific Electronics carries a five year guarantee and servicing and back up are available locally.

For more information contact Mr Peter Lloyd, Scientific Electronics, 6 Holloway Drive, Bayswater, Vic 3153. Phone (03) 762 5777.

70kHz-250MHz grid dip meter

Parameters Pty Ltd now has available the Trio DM-801 dip meter designed for the testing and adjustment of radio equipment and antennas operating in the frequency range 70kHz to 250MHz.

Applications of the DM-801 include measurement of the resonant frequency of antennas and turned circuits using either inductive or capacitive coupling, use as a signal generator, as a field strength meter and an inductance or capacitance indicator.

The ability to be capacitively coupled to the tuned circuit under test is said to be unique to the DM-801. With the DM-801, resonant frequency of shielded and toroidal coils can be measured by simply touching the capacitance probe to the circuit under test.

Other features of the DM-801 include wide frequency range, internal storage of coils, probe, earphone and ground clip lead, battery power, amplitude modulation, and sockets for crystal checking.

For more information contact Parameters Pty Ltd, 41 Herbert St, Artarmon, NSW 2064 or 53 Governor Rd, Mordialloc, Vic 3195.

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

RAVEL CONCERTOS: "Masterpiece for piano, orchestra"

RAVEL: Piano Concerto in D-Major for the Left Hand. Piano Concerto in G-Major. Jean-Philippe Collard, piano, with Francois Merville (cor anglais). Orchestre National de France, conducted by Lorin Maazel. Stereo, World Record Club R-09873.

The sound of the first few bars of this so often recorded coupling are disappointing but don't let this discourage you from listening to the rest.

If you miss the rest – all of it – you will be missing something you will wish you hadn't. Personally I prefer it to any other recorded coupling of these two pieces that I have so far heard.

My objection to the first few bars is due to the somewhat anaemic quality of the very first sforzando chord and, immediately thereafter, the lack of balance between piano and orchestra. The piano almost disappears!

But let me reassure you that this is soon righted and you will – if you are like me – sit back and enjoy approved tempos, technical security, and sensitive feeling for much important detail.

By the way, to make things clear, the lapses I mentioned above refer only to the G major and not the concerto.

By the way, the pianist, Collard, has an English name but he is actually French. His first names are Jean-Philippe.

He is a sensitive, very well equipped artist, never too expressive in long slow solos. In the two fast outside movements he is brilliant and I never heard a hint of a stumble, no matter how fleetly he is playing.

He takes the middle movement, marked adagio assai, rather more slowly than is usual. Most other pianists prefer to take it a little faster than Ravel's marking suggests.

But the melody's long, Bach-like shape stands up well to this statement of it and Collard is careful to avoid dynamic and tempo variations quite in keeping with the composer's intentions. He is accompanied with the same elegance that he at all times displays himself.

The Concerto in D for the left hand alone was commissioned by an Austrian pianist who lost his right arm during World War I. Ravel replied with a work that is not only extremely musical but technically intricate. It is played here with such bewildering ease that anyone not in the know would swear Collard was using two hands.

There are a few resemblances to the G major concerto, especially in the slow Gershwin phrase that won such popularity in the earlier work and did much to send the audience away whistling it.

The performance is a masterpiece for both piano and orchestra, neither work allowing the listener's attention to wander for a moment. To enjoy the disc don't concentrate on either concerto's more showily difficult sequences; enjoy also Collard's ravishing soft passages.

There is one non-musical point I should like to make. The design of the record sleeve is awful. Not only are the portraits of the pianist and conductor unrecognisable but neither's name is mentioned on the first side and you'll only discover them by carefully studying the small print on the reverse side.

I mention this because the usual quality of WRC art is so good; and, more importantly, because a potential buyer, looking at a display of new releases, might not bother with more than a glance at this cover, so missing something really good inside. (J.R.).

ZAMFIR — But what on earth is a Rae?

ZAMFIR-Georghe Orchestra; Roumanian Radio-Symphony Orchestra; Paul Popescu (conductor); and the Madrigal Choir. The Rae player's name is not given but everything points to its being Zamfir. Philips Stereo 9101 (analog).

Who is Zamfir and what is his instrument, called in his native Rumanian, a Rae? I must confess that I had no idea until I watched that great film "Picnic at Hanging Rock" on TV, recently. In this, the instrument is used for the excellent background music.

Then I learned from the sleeve of the disc sent to me by Philips for review, that Zamfir is a Rumanian musician and that Rae is his countrymen's name for a very large, gracefully curved type of pan's pipe. Not one of those little things that Mozart used in The Magic Flute but something that looks like a giant sized geometrical gadget. When the tops of the pipes are blown across, they produce a sound rather like the low register of a recorder.

It is used by Zamfir as a solo instrument in, of all unexpected compositions, a Mass For Peace. Usually it is so recorded that the support of the Roumanian Radio Orchestra passes unnoticed. But one feature is immediately obvious.

Zamfir is a master of this mellow toned instrument. He can produce alluring slow sounds and passages that could challenge the presto of a flute. But to me it sounds oddly out of place in a Mass. A moments reflection will remind you that a pan's pipe was a pagan instrument anyway!

The whole of this Mass consists of only four parts – a Kyrid, Gloria, Sanctus and Agnus Dei. Musically, it is a mixture of orthodox liturgical and what passed for modern in the early 1920s.

In parts it is beguilingly soft, quite enchantingly so; in other parts, it can

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

assert itself almost pugnaciously. Its usually bland sound can become surprisingly shrill.

And there are long passages that sound much more like a waltz than a Mass.

The first band on the reverse side, which concludes the Credo on the first, sounds more like a lively Balkan dance than anything else. However there is a most refined choral opening to the Sanctus.

The cover picture which seems to have been taken from a dully coloured stained glass window has great charm. And so will the contents to those who like musical freaks. (J.R.)

☆ ☆ ☆

DELIUS — Florida Suite; Dance Rhapsody; Over the hills and far away. Royal Philharmonic Orchestra conducted by Sir Thomas Beecham. World Record Club Stereo R 08083.

A rather unlovely sleeve disguises much enjoyable music on WRC's reissue of some Delius pieces under the name of Florida Suite. This is a four-piece confection first produced in 1859, and now in a revised edition by Sir Thomas Beecham. Apart from the unattractive yellow and green cover there are large portraits of Beecham with black beard and Delius with front hair! You have to look hard to recognise them.

Those Delians who do not know the Florida Suite are in for a pleasant surprise. It is an early work and shows only few of the composer's later musical characteristics. Try it on your friends and see if they can guess who wrote it. By the way it is, alas, one of only two works that Beecham recorded in stereo.

Yet despite its age its sound can still be enjoyed. The bloom on the strings, the delicately controlled woodwind and perfect balance of the orchestra remind one with regret of Beecham at his best.

The Florida Suite consists of four movements — Daybreak; By The River; Near The Plantation and At Night. It is all mellifluous and wherever one spots hints of Delius' later scoring habits and his tendency to "slippery" modulation, Beecham must always be suspect.

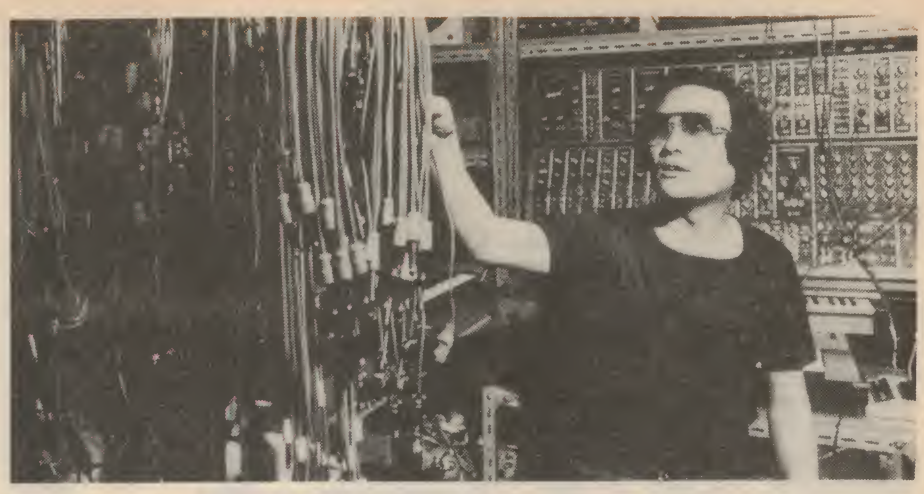
I say this because Beecham's manner of conducting Delius' music was very odd. I have heard him labour long at rehearsals to get a movement or even a passage the way he wanted it and at the same night's performance play it quite differently — yet it still sounded lovely!

But one thing is clear — here is an original mind striving to make itself heard. It could never justly be dismissed as a mere student work. Beecham treats it as quite grown up.

One has to hurry forward 57 years to catch up with the composition of the next piece on the disc, the Second Dance Rhapsody. It is a now well known composition in Delius' mature style, although this also was "edited" by Beecham. There are not surprises. Just good Delius in genial mood and spreading charm in every bar.

It was composed in 1916 and we again retreat, this time to 1857 to date the next composition: Over The Hills And Far Away. But there is little in it to suggest an early work. It is a work that very aptly indeed succeeds in musically describing its title all the way from the ground to the peak.

As I stated above the sound is still good, good enough for any true Delius lover to acquire. (J.R.)



Desert trek or a space odyssey?

GRAND CANYON SUITE, Grofe. SYNCOPATED CLOCK, Anderson. Isao Tomita and the Plasma Symphony Orchestra. RCA Red Seal stereo ARL1-4317.

If you want to get some idea of the complexity of "orchestral" textures which engineer/musicians can now create with a room full of synthesisers, you could do worse than study a recording by Isao Tomita.

Born in 1932 in Tokyo, he majored in the history of art at Keio University but, at the same time, developed a passionate interest in music and electronics. He published a number of successful compositions but hit the world headlines in 1974 with a huge-selling album "Snowflakes are Dancing" — an interpretation of the music of Claude Debussy on synthesiser.

This was followed by electronic interpretations of "Picturers At An Exhibition" (Moussorgsky), "Firebird" (Stravinsky), and "The Planets" (Gustave Holst). Now we have the coupling "Grand Canyon Suite"/"Syncopated Clock" — the latter a very short item, virtually a novelty fill.

For the Grand Canyon Suite, Tomita lists the composition of his electronic orchestra — violins, viola, cello, double bass, piccolo, flute, oboe, English horn, clarinets, bassoons, trumpet and so on, through to the "kitchenware", to novelty instruments, chorus and whistlers. To produce these sounds, he draws on synthesisers identified as Moog, Roland, Yamaha, Synclavier, and so on. If you buy the record, the listing is there for you to study.

But, alas, when I was playing the record, a member of my family walked through and, with a certain disdain, remarked: "I'd rather have the real thing!" At that point in the recording, I must confess to a similar reaction.

Tomita uses the traditional instrumental sounds to produce an orchestral foundation but his superimposed improvisations change the whole scene. In fact, the interplay of colour, light and shade on the Painted Desert sounds more like music for a space odyssey, while a solo synthesised harmonica contracts the procession of mules to something more like one man and his donkey!

Not that Tomita lacks initiative and musical skills, or the equipment the ability to produce an enormous variety of synthetic and authentic sounds; it's just that your reaction will depend entirely on whether you're interested in Grofe or Tomita!

As mentioned earlier, "Syncopated Clock" is a novelty fill using an amazingly convincing chorus of whistlers. But for the notation that the sound was produced by "Moog III, Program 8", one would be prepared to believe that a group of male voice choristers had suddenly changed the whole mode of their music making.

As for the sound quality, it's very clean, as it should be when the signals are coming from an array of electronic oscillators. (W.N.W.)

WEBERN — Six Orchestral Pieces played by the London Symphony Orchestra conducted by Pierre Boulez. CBS Stereo 76911. (Analog).

I think that, by now, regular readers of this column will have gathered that I have no love for the music of the Second Vienna School and its disciples. I find it, for the most part, as ugly as German expressionistic painting.

And I might mention, spitefully, that I find satisfaction in its overwhelming rejection by the great majority of regular concertgoers. That most of it, but with significant exceptions, can be described as music at all is to me an insult to the muse.

I suppose that, in time, real music will be born again but, until then we have to keep returning only too often to the increasingly dusty 19th century romantic museum and the all too frequent repetitions of the baroque — which of course also has its splendid exceptions.

These remarks are prompted by the fact that Boulez found the time (11 years) to produce a set of Webern's miniscule pieces.

The selection on this disc comprises six dwarf compositions, the longest a symphony that lasts nine minutes. The rest of the works are made up of a few brief bars too numerous to mention even by name.

I suppose they are well played but their compression and contortions make it too difficult for me to judge. However, I can write with a clear conscience that they are neat. (J.R.)

FOOTNOTE: I didn't know what I was letting myself in for when I accepted Rachmaninoff's complete piano music to review. Later I found it consisted of seven LPs. I am therefore afraid there will be some delay before my review appears. My apologies.

FANDANGO, Herb Alpert. A&M LA 37810. Festival release.

It is a long time since I've heard the unmistakeable trumpet style of Herb Alpert, with it's distinct south of the border flavour.

This disc is described on the label as an Audiophile record. I could not find any reference on the label to half-speed mastering or to other such technique but the quality is superb: alive, with excellent balance and with virtually no background noise.

Recorded at CBS studios in Mexico City and A&M studios in Hollywood, the 11 tracks are: Fandango — Margarita — Push And Pull — California Blues — Quiereme

A NEW HIFI DEMO DISC?

BEETHOVEN: Piano Sonatas, Opus 57, Appassionata. Opus 111, The Last Great piano sonata. Carol Rosenberger; Rosendorfer Imperial Concert Grand. Digital stereo, DMS Delos, DMS 3009. [From P.C. Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4122. Phone (02) 343 1612].

Some time ago I reviewed Carol Rosenberger's first Delos digital release "Water Music of the Impressionists" (Liszt, Debussy, Griffes, Ravel) DMS 3006. Others seem to have shared my enthusiasm for that recording because, since then, it has received frequent mention as a notable and very acceptable audiophile disc.

Now we have Carol Rosenberger with two noteworthy Beethoven sonatas.

I am not about to draw comparisons between this and other perfomances of the works, partly because I lack the resources — and the incredible memory — of our regular classical reviewer, Julian Russell. More than that, reactions to individual performances of such works are highly subjective, as becomes apparent when one even glances back over past reviews.

One thing is certain. Carol Rosenberger possesses in generous measure the physical resources to cope with the emotional passions and turbulance of the Opus 57 "Appassionata", written in the summer of 1806, when Beethoven's mind was in a turmoil, as revealed by his letters to the "immortal beloved".

More than that, she has at her command the magnificent Bossendorfer Imperial Concert Grand, with its enormous power in the bass register. And, to record the sound, a Soundstream digital master tape system plus the combined disc production resources of Ortofon, Mobile Fidelity Sound Labs and JVC.

They are used to the full in the opening movement Allegro assai.

Then suddenly, the passions subside into the calmness of the Andante. Carol Rosenberger is contemplative and tender; the huge Bosendorfer is bell-like in its quality and the digital recording preserves perfectly the lingering echoes of each note. As I listened, I couldn't help but recall past arguments about the supposed limitations of digital with low level sound!

And then, as if to underscore the dynamic range of the recording, as well as the inspiration and vitality of the composer, comes the turbulent Finale.

As an encore, you have Sonata opus 111 on the other side — described by Beethoven's biographer Wilhelm von Lenz as the "Testament Sonata . . . the master's great farewell to the piano sonata, his final statement in that form". Or, as Virgil Thompson put it: "representing the whole gamut of dynamic violence and delicacy and deep song, with its undercurrent of musical meditation."

The last incidentally, is a quote from Carol Rosenberger's own essay on the composer, the instrument and the sonatas, occupying best part of six volumns of small type on the handsome double-fold jacket.

Unless I miss my guess, this new recording, datelined 1982, is going to follow "Water Music of the Impressionists" into the published lists of recommended audiophile recordings. (W.N.W.)

Tal Como Soy – Route 101 – Coco Loco – Aria – Angel – Sugarloaf – Latin Medley.

There is no mention of the other artists but they all do a great job of creating a fresh Latin sound for you to enjoy. (NJM)

DEVOTIONAL

COUNTRY SONRISE; various artists. The Word 20 Series, TWE 6007. [From Word Records Australia, 18-26 Canterbury Road, Heathmont Vic 3135. Phone (03) 729 3777.]

For those that like their Gospel music with a distinct country and western flavour, this record would be compelling listening, with 20 tracks from 20 different artists, known mainly for their prominence in the country music scene.

The sound quality overall is good, considering that there must have been a considerable difference in the age of the original recordings.

Some of the artists and their songs are as follows: Ray Price, I Saw The Light; B. J. Thomas, Using Things And Loving People; Lester Flatt, What A Friend We Have In Jesus; Jimmie Davis, This Little Light Of Mine; The Cathedrals, The Last Sunday; Wanda Jackson, Heaven's Gonna Be A Blast; Roy Clark, He Is My Everything; Tennessee Ford, I Like The Old Time Way; Roy Rogers & Dale Evans, I'll Fly Away; Stuart Hamblen, This Old House.

Each track is supported by a brief note on the jacket, either about the composer or the artist(s). The record is one of a whole series from Word, each containing 20 tracks. Some of them feature individual artists such as Burl Ives and Pat Boone. (N.J.M.)

☆ ☆ ☆

PAT BOONE, Whispering Hope. The Word Twenty Series TWE 6008, [From Word Records Australia, 18-26 Canterbury Road, Heathmont Vic 3135. Phone (03) 729 3777].

This is another album in Word's 20 series, with 20 Gospel tracks from Pat Boone, mainly old-time Gospel favourites.

The sleeve notes give an interesting and frank insight into some of the problems that Pat Boone has had to face in coming to grips with his Christian faith and the conflicting demands made on him in the tinsel world of show business.

Some of the titles are: Whispering Hope – Yield Not To Temptation – Have Thine Own Way Lord – I Walked Today Where Jesus Walked – Saviour, Like A Shepherd Lead Us – How Great Thou Art – Let the Lower Lights Be Burning – Blessed Assurance, Jesus Is Mine – What A Friend We Have In Jesus.

Pat Boone's style in these old hymns may not set the world on fire, but he sings them with obvious feeling and sincerity. (N.J.M.)

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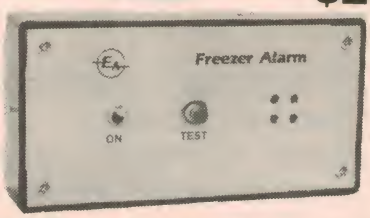

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October 1932

The Tariff Board enquiry: The matter of variable condensers was before the board and a witness gave evidence that the Australian-made condensers were not sufficiently accurate. So the chairman asked a certain importer what was the degree of accuracy built into the British-made condenser, to which he got the prompt reply of, "To within one-quarter of a micro-microfarad."

The representative of an Australian firm jumped to his feet and exclaimed that the Australian-made condensers were even more accurate, being checked to within a quarter of one percent. And there wasn't anyone in the room smart enough to point out that the Australian condenser was only one-fifth as accurate as the imported job.

☆ ☆ ☆

After death — what?: Miss Clara M. Codd will say at 7.30 on Sunday nights during October from 2GB; and Mr Harold Morton will give his version at 8. In November there will be discourses on reincarnation, and in December on evolution.

☆ ☆ ☆

The Voices: It has been brought to our notice — the editor brought it to our notice (we hear from an unreliable source) — that the number of people being admitted to lunatic asylums suffering from radio reception is on the increase. These people assert, against all bribes offered by psychologists, that they can hear broadcast programs without the aid of a broadcast receiver; they say that even against their inclinations, which should be pretty strong, they hear broadcast programs at all hours of the day and night, and can sleep only between 11.30 pm and 7.30 am, when the local stations are off the air.

October 1957

TV tower: The new aerial at ABN TV station in Sydney is now in use. The structure consists of a tower 335ft high upon which is mounted the 99ft TV aerial. This has two sections operated in parallel by separate, air-filled, coaxial cables, eight bays in all, and with a gain of six times.

Each section can be operated separately if desired. Above this aerial is a 70ft steel pole for future use — it could for instance support an FM aerial. Total height to the top of the pole is 504ft.

☆ ☆ ☆

Space travel soon: Space travel is only 20 years away according to Mr H. Ward, director of the NZ Physical Laboratory.

Mr Ward, who is a member of the New Zealand International Geophysical Committee, said that although earth satellites to be launched shortly were only 20in in diameter, larger satellites of three or four feet were already under consideration.

☆ ☆ ☆

New era in warfare: "A missile was fired at the Air Force Missile Test Centre's Cape Canaveral launching site today. Shortly after the launching, the missile exploded. There were no casualties. Valuable information was gained as a result of the test." This terse announcement by the US Air Force recently was widely interpreted as heralding a new era in warfare — the era of the awesome Intercontinental Ballistic Missile (ICBM).

The test missile, though not specifically identified by the Air Force, was reported by the press to be the 5000 mile, ocean-spanning Atlas on its first flight from the Missile Test Centre in Florida. This "ultimate weapon" would bring American retaliatory striking power within a scant 20 minutes of Russia.

New product from Dick Smith

Wizzard Video Game + Personal Computer

Many people cannot make up their minds whether to buy a personal computer or a video game console. The Wizzard from Dick Smith is a third possibility. It is primarily a video game console but has the capability to be upgraded to a personal computer with the addition of a Basic interpreter cartridge.

If you or other members of your family are video games fanatics you will naturally be interested in this latest release from Dick Smith Electronics. It is called the Wizzard and the improbable spelling is not a printing error. The Wizzard can be had with a range of games cartridges (each at extra cost) which have a high degree of animation and make good use of graphics and colour capability.

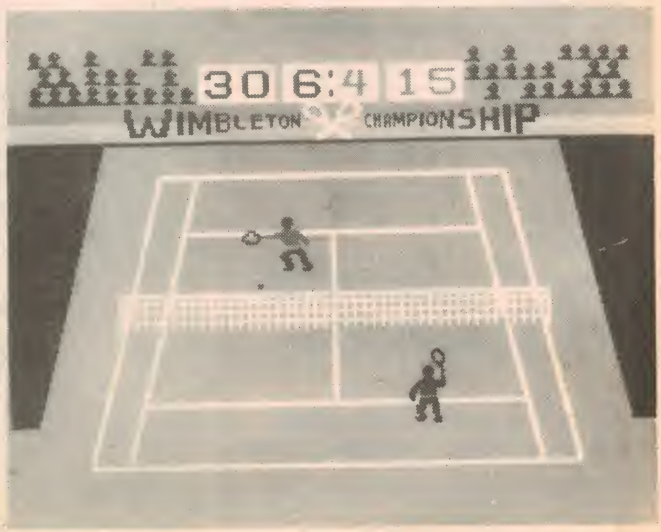
As well, each game has music and sound effects.

The Wizzard console is largely finished in matte black plastic with fake woodgrain end-panels. Dimensions are 355mm x 60mm x 230mm (W x H x D). There are two joystick controllers and these are attached to the console via a coiled cord which can extend about 60cm. A button on each side of the joystick controller provides a "fire" controller while a 24-way pressure sensitive keyboard (like the Sinclair ZX81) is also a feature. In the normal games mode, a coloured plastic cover is slid over these keyboards and only two of the "buttons" are used. In the computer mode each joystick controller is clipped into the console to form a 48-way keyboard in a more or less conventional "QWERTY" format.

In the games mode, the joystick controllers are quite effective although their capability of moving an object in any of 16 directions does not appear to have been fully utilised in any of the games we tried. The joystick controller actually only has eight contacts in its membrane but the software interpolates between these (when two contacts are closed) to give 16-direction capability. The "fire" buttons are also effective but strangely, they are not mentioned or described in the instructions. This means that unless you happen to discover their operation by accident, you are likely to use the adjacent contact keyboard buttons instead, because of the labelling of the keyboard overlays. And using the keyboard for games is a real chore. As with other video games in this price range, the sound effects are produced from the TV set loudspeaker rather than in the console.

All the circuitry inside the console is accommodated on a double-sided PC board measuring approximately 300 x 125mm. The microprocessor used as a version of the Mostek 6502A in conjunction with what would appear to be a CRT controller and PIA of unknown make. The mains power supply is external to the unit and plugs in via a 5-in DIN socket.

The games cartridges use 2716 and 2732 EPROMs and plug into an edge connector slot on the side of the Wizzard console. The TV antenna connection is via a cable fitted with a 75Ω plug and the connection can be made per-



This is a frame from one of the Tennis games. Some of the detail on the review sample was different including the name "Wimbleton", to Wimbledon. Notice that the ball casts a shadow.

YOU'D BE CRAZY TO BUY A TV GAME

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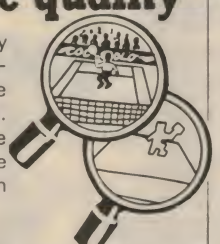

Amazing picture quality with over 49,000 dots — over twice as good as the largest selling TV game. You'll be amazed at the clarity, the detail — just like the screens NASA use in the space shuttle!

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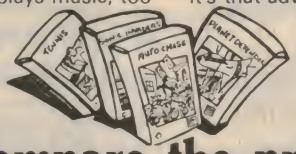
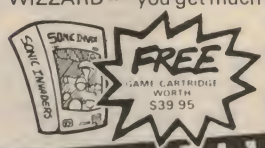


Compare the price

The best part of all: the Dick Smith WIZZARD is around $200 cheaper than the closest comparable computer! Yes, you not only save a fortune by buying the Dick Smith WIZZARD — you get much greater flexibility and enjoyment!



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DICK SMITH Electronics

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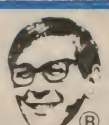

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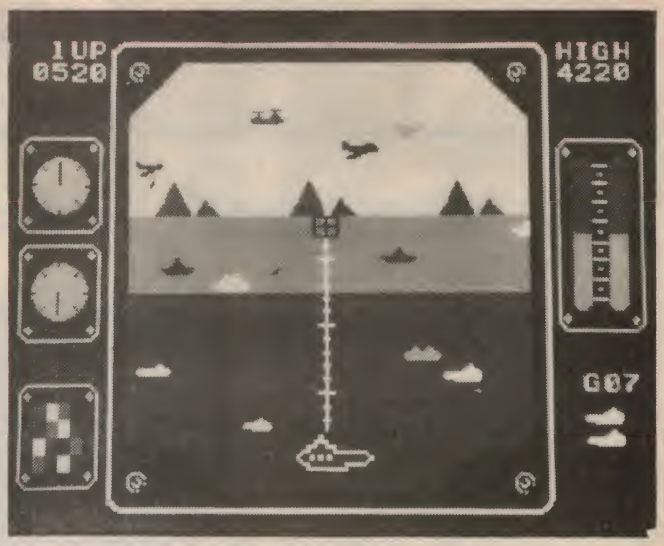


These photos are frames from the Planet Defender and Air/Sea Attack game cartridges. Note the good graphics resolution.

manently via the supplied antenna switch box. The inbuilt RF modulator is set to Australian channel one.

Each games cartridge is supplied with an instruction sheet which lists the game features and the multiple versions which can be for one or two players. We tried a selection of game cartridges and can report that they are quite impressive in comparison with competing video game systems. The colour and graphics capability are used to good effect and in some cases quite cleverly.

Probably the best of the games is the Tennis. This has 16 versions on the one cartridge and includes versions where one player is handicapped so that youthful and ancient players are more evenly matched. Rather than showing a two-dimensional court, an orthogonal projection is used to simulate a three-dimensional game where the ball can go over the players' heads and it casts a shadow!

As might be expected, the players' positions are controlled by the joystick and their choice of forehand or backhand play is determined by their position vis-a-vis the ball. Velocity of play is also affected to some extent by the use of the joystick.

This game really does go a long way towards simulating an actual game, even to the amount of tension and perspiration it can produce!

Sound effects for the various games are fairly predictable and in line with those on comparable video games. Each game has its own signature tune which is played at the beginning and end of each set. This begins to pall quickly, especially if one is losing repeatedly in one-sided games with the machine.

Picture quality on most of the TV sets we tried with the Wizzard was very good. The exception to this was one set which was affected by bad herringbone interference. However, the other sets were so good that we are inclined to suspect that the latter set was faulty.

Having discussed the games we can pass on to what is perhaps the main feature of the Wizzard and that is the computer option. With the addition of a Basic cartridge the unit will function as a personal computer. On the basis of its features, the Wizzard Basic would appear to be roughly comparable to that in the Tandy TRS-80 (level II) in that it has a full range of mathematical functions (with floating point arithmetic) plus string functions.

The sound facility of the Wizzard is programmable by SOUND commands which control the volume and pitch of four channels (giving chord capability) over a range of 2½ octaves (30 notes). Graphics characters can be created using the CHAR command to fill in an 8 x 8 matrix. These special characters can then be placed anywhere in 32 x 24 grid on the screen using the PLOT command.

The Basic interpreter is resident in 8K EPROM in the cartridge. Total RAM in the Wizzard is 17K of which about 11K is available for user programs. A cassette interface and deck will shortly be available to clip on to the side of the Wizzard console. And the inclusion of LPRINT and LLIST statements in the Basic also suggests that a printer interface may also be in the pipeline.

Naturally, colour can also be added with a COLOR command.

An expansion interface will also be available eventually, to plug into the cartridge connector. This will ultimately give the machine a total memory capability of 48K in RAM.

While it all sounds very promising as a well-optioned personal computer, it is too early to judge the final product. At the time of writing we had only a few hours to try a preliminary Basic cartridge which did not have all the features mentioned above. Nor was the supporting Basic manual, presently being prepared, available.

The Wizzard looks as though it could eventually be a worthy competitor to

Continued on p141

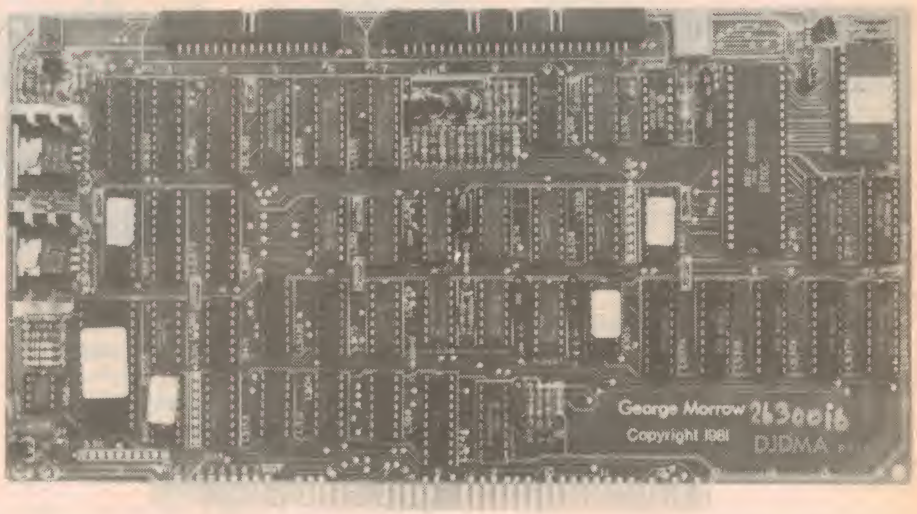
Microcomputer News

New "intelligent" disk controller from AED

AED Microcomputer Products has released a new S100 floppy disk controller board which, they claim, offers superior performance and features to alternative designs. Designed by George Morrow of Morrow Designs, the board is fully compatible with the IEEE 696 specifications for the S100 bus.

The controller transfers both operating instructions and data to and from the system memory by Direct Memory Access, providing a high operating speed with minimal use of the resources of the main processor. The DMA channel can be located anywhere in a 24 bit address space, so the board is suitable for use in extended address systems.

Instead of the more usual dedicated floppy disk controller chip the AED board uses a Z80 microprocessor. The board can be used with a wide variety of disk formats, with the controller automatically determining the length of sectors to be read and whether the disk to be read is single or double density and single or double-sided.



In addition it is possible to change the controller's parameters either by reprogramming the on-board EPROM or down-loading a special purpose controller routine into RAM on the board. Unlike many other boards the AED board can control both 20cm and 14cm disk drives concurrently.

For more information on the new disk controller contact AED Microcomputer Products, 130 Military Rd, Guildford, NSW. (02) 681 4966.

Apple takes action against imitators

In an effort to stop manufacture and distribution of imitation Apple II computers, Apple Computer Inc has filed a number of lawsuits in Taiwan, Hong Kong and New Zealand. Investigations are said to be continuing into the situation in Australia, Japan and Singapore.

In July, Apple brought a civil action against the Taiwanese manufacturer of the "Apollo II" computer, claiming that it was a copy of the Apple II. As a first step in the action Apple seized evidence in a surprise raid on the Apollo II factory in Taipei, as permitted under Taiwanese law. A similar action against another manufacturer is planned, and the government of Taiwan will help to prevent the export of Apple copies according to the company.

In Hong Kong, Apple filed a civil action under local patent laws against a small manufacturer selling alleged Apple copies. A number of the machines of the company were seized as evidence in a raid similar to the one in Taiwan. Apple expects to halt all manufacturing and selling of Apple copies under Hong Kong patent and copyright law.

Apple has also obtained an injunction against a New Zealand company alleged to be selling "Orange" computers from a Taiwanese manufacturer in breach of Apple licensing rights.

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MEMORY
A 64K Ram board is provided as standard. However the system may be provided with as little as 8k if desired and more added later.

POWER SUPPLY
Provides 8.5V, +12V, −12V unregulated supply to the buss. All components are P.C. board mounted and fuses readily accessible.

PERIPHERALS
Additional VDUS, Dot Matrix Printers, Daisy Wheel Printers, 8" and 5" Floppy Disk Systems, and a hard disk drive of up to 40MB may be connected to the system. Interface boards and software are available to support all these devices in a singular or multi-user environment.

INPUT/OUTPUT
8 I/O Boards slots are provided, each of which may be fitted with a dual serial or dual parallel interface board using DB-25 "D-TYPE" Connectors. Many other types of interface Boards are also available.

CABINET
The Cabinet is made of heavy gauge (approx 1/8") Aluminium Anodised in Delightful blue.

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Approx: 16" wide by 20" deep by 7.5" high.

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Approx. 10KG. (including supply, CPU, 64K RAM, and I/O board).
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Microcomputer News

32K RAM expansion for Sinclair ZX81

Vendale Pty Ltd now has available a 32K RAM expansion unit for the Sinclair ZX81. The ZX81 normally works with up to 16K of RAM, and when switched on with the Vendale RP32 unit in place will come up as a 16K machine.

A single POKE instruction activates the second bank of 16K, which is then available for storage of data variables and Basic programs. The unit uses dynamic RAM chips with refresh and bias voltage generation taken care of on the board. According to Vendale no extra power supply is required.

The RP32 costs $165 including postage and is available from Vendale Pty Ltd, PO Box 456, Glen Waverley, Vic 3150.

Modular business software from IMS

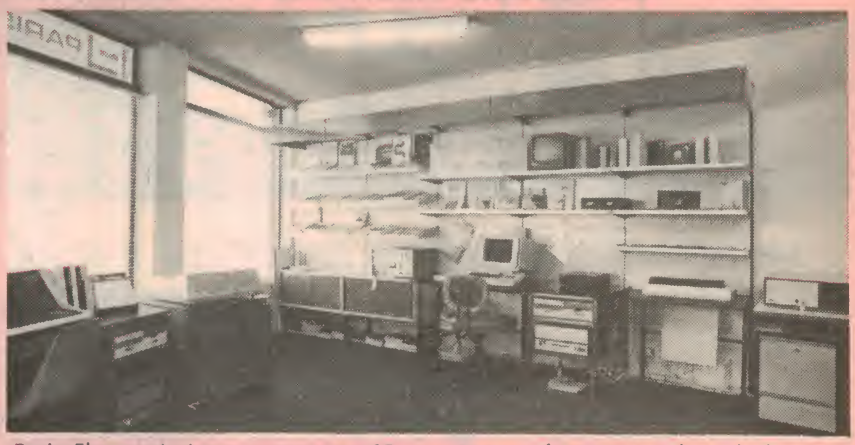
A new concept in software marketing was unveiled recently by leading Australian software house IMS Computer Systems Pty Ltd. "Ascent" is a new series of modular business software packages which allow users to start with a minimal package and add modules to suit as their business expands.

As Managing Director of IMS, Mr Bryan Gardiner, explained: Ascent will "fit small machines, such as the Osborne, while providing access, through modules, to the most highly powered micro-based accounting software available in the world".

Ascent provides a powerful basic package to cover Accounts Receivable, Accounts Payable, General Ledger and Stock Control, with the option of adding any of a further 18 modules.

For more information contact IMS Computer Systems Pty Ltd, 582 St Kilda Road, Melbourne 3004. (03) 51 9156.

New store for Paris Radio Electronics



Paris Electronics' new store at 165 Bunnerong Rd, Kingsford, NSW, is worth a visit for anyone interested in SS-50 bus systems, such as the SWTPC, Gimix and Sphere computers.

A wide range of software for 6800 6809 and 68000 systems is also available, including the Flex disk operating system for the TRS-80 Color Computer.

Peripherals, including Epson and Anacom printers, SWTPC terminals and Paris Electronics' own disk drive units can be provided, in addition to a range of expansion boards for SS-50 systems.

Latest new products are the "Speech Systems" speech synthesiser and music boards for the SS-30 bus. Two versions are available, one using the National Semiconductor Digitalker chip set and the other the Votrax SC-01 chip. Both units include an on-board amplifier and 8-bit D/A converter for sound effects.

Paris Electronics offer a mail order service. The address is PO Box 380, Darlinghurst, NSW 2010. Telephone (02) 344 9111.

Disk upgrade kit — more power to Sorcerer

PJB Systems now has available a disk upgrade kit for the Exidy Sorcerer computer. A pre-programmed EPROM is supplied to replace one of the Sorcerer Monitor ROMs, and adds the following features to the Sorcerer:

- Automatic boot of disk — as soon as the Sorcerer is switched on the new ROM automatically loads the disk operating system. Pressing the two Reset keys has the same effect.
- Easy Monitor entry — entry to the Sorcerer Monitor can be made from disk mode or from RomPac Basic by pressing Control-C and Reset together.
- Easy entry to RomPac Basic — from disk mode or the Sorcerer Monitor, entering Basic is a matter of pressing the ESC key and Reset together, causing a cold start of Basic.

The upgrade kit will work with both Micropolis (Mod 1 and Mod 2) and Exidy FDS disk drives. With no disk attached the Sorcerer behaves normally, with the added advantage of being able to use features 2 and 3 listed above.

For owners of Micropolis drives the PJB kit provides an added advantage. By rewiring the Basic RomPac they can have a full 48K of RAM and still use RomPac Basic.

For more information contact PJB Systems, PO Box 252, Forestville, NSW, 2087.

Microcomputer News

Radio University microprocessor course

Following on from his popular Radio University courses in Microprocessor Fundamentals, Dr David Mee of the University of NSW School of Electrical Engineering will broadcast a new course on "Microprocessor Applications" over the University's radio station starting in early October.

The course will cover applications of microprocessors in a variety of common situations, with projects including a complete single chip analog data acquisition, display and control system for water heating, EPROM programming for a single chip microcomputer, a raster scan terminal and subsystems for communications and magnetic data storage.

Eight lectures will be broadcast by University Radio VL2UV at 7pm on Tuesdays, repeated at 8pm Thursdays. Transistor radios adjusted to pick up VL2UV can be purchased from Radio University for $10 post paid. One lecture will be transmitted over VITU, the University's television station, and there will be two attended seminars held at the University.

The course fee of $27.50 includes a comprehensive set of notes in addition to lectures and seminars, and the course will be available on tape following the broadcasts, for $8 per lecture.

For more information on this course and others offered by Radio University contact the University, PO Box 1, Kensington, NSW, 2033 or phone (02) 622 2691.

Club news:

The Microcomputer Enthusiasts Group meets at St Andrews Presbyterian Church Hall, 31 Anderson St, Chatswood, on the 3rd Monday of each month, from 7.00pm. All are welcome to attend.

Apple-Q, the Brisbane Apple User Group meets every third Sunday of the month (except December) at the Hooper Education Centre, Kuran St, Wavell Heights. The Centre is open from 8.30am to 4.30pm, and barbecue facilities are available for members staying the day.

Subscription fees for the club are $18 per year. Further information is available from the secretary, Apple-Q, PO Box 721, South Brisbane, Qld, 4101.

The Christchurch 80 users' group has been operating for about 18 months, and boasts a regular attendance of 50 at meetings. Main interests are the TRS-80 and System-80 computers and the group publishes a monthly newsletter.

Meetings are held at 7.30pm on the last Wednesday of each month at St John's Church Hall, Latimer Square, Christchurch. For further information write to the club at PO Box 4118, Christchurch, NZ.

Atari Computer Enthusiasts (NSW) meets on the first Monday of each month at the offices of I. P. Sharp Associates, 8th Floor, Carlton Centre, 55 Elizabeth St, Sydney. The group publishes a very well presented newsletter containing programs and Atari computer information and tips.

Postal address is 78 Ayres Rd, St Ives, NSW, 2075.

"Software for the Super-80 Computer" is now available from "Electronics Australia". See our advert p107.

Commodore VIC-64 is on the way

Commodore displayed the new Commodore 64 computer at the Data '82 exhibition in Sydney in August. The machine is physically identical to the VIC-20, although in beige plastic, but offers an expanded range of features.

The basis of the new machine is a new microprocessor developed by Commodore subsidiary MOS Technology. The 6510 processor uses the same instruction set as the 6502 but has additional input and output lines. Commodore are calling it a "significant advance in technology".

Features of the new computer include 64K RAM as standard, although only 39K are available to the user from Basic. A high quality music synthesiser is built in, with three voices, each with a nine octave range, a choice of four waveforms and programmable attack, decay, sustain and release (ADSR) for envelope shaping.

Graphics resolution is 320 x 200 pixels, in 16 colours, and with eight independently movable "sprites" available for animation and games.

Basic for the Commodore 64 is the same as PET Basic and PET style graphics characters are available from the keyboard. The text display is 25 lines of 40 characters each, in any of the 16 colours available. Programmable graphics characters allow the user to replace the character set with a customised set.

Release date and price of the Commodore 64 are unspecified as yet but Commodore in NSW expects the machine to go on sale either late this year or early next year. Price is quoted as "under $1000".

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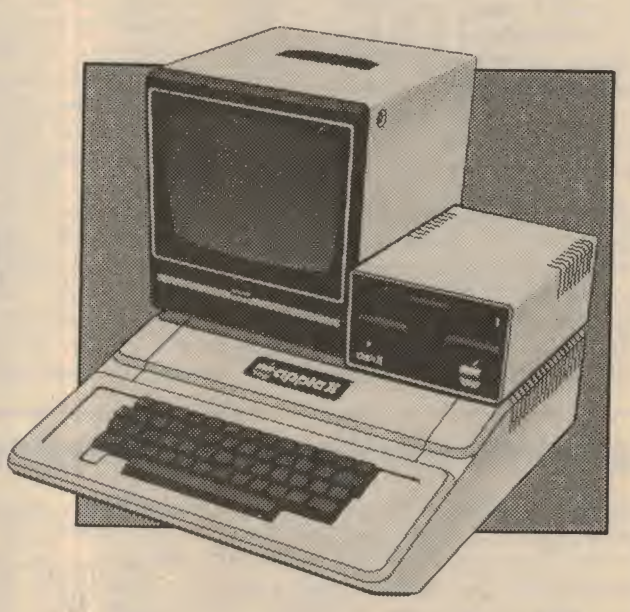

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INFORMATION CENTRE

6-DIGIT CLOCK: I built the 6-digit crystal clock described in the March 1979 issue. It all worked at switch-on but it runs much too fast, gaining 12 seconds per minute. Is this due to an incorrect timebase? I believe there are two versions of the MM5369 and I may have the wrong one. (P.Q., Redfern, NSW).

● The crystal timebase for this clock used the National Semiconductor MM5369 oscillator/divider chip to derive a 60Hz signal from the American colour TV subcarrier crystal at 3.579545MHz. Recently, a different version of this chip has become available which has a 50Hz output. This device is coded MM5369-EYRN. However, it seems likely that you have the former version as specified and the problem really is that a track on the PC board, connecting the 50/60Hz select, pin 11, of the MM5314 clock chip to the 0V rail, is open circuit. We suggest you check this track very carefully for cracks.

GRAPHIC EQUALISER: My EA graphic equaliser recently went off song and on checking was found to have eight defective op amps. Only two ICs were completely functional. After replacing the duds, this time in sockets, and finding everything else normal, I searched for a cause. Possibly the use of single tantalum capacitors at the inputs was to blame, for while they are okay unpolarised for small signals, around 1 volt p-p, large reverse signals such as DC offsets at switch on will be passed on. I have noted that in some Japanese amplifiers they are used as back-to-back pairs.

So I drilled holes, cut tracks and installed paired capacitors at the inputs and outputs.

While the equaliser was on the bench, I looked for the source of the hiss which was apparent when the equaliser was switched into circuit. About one millivolt was visible on the CRO, all apparently coming from the 100kΩ buffer amp input resistors. Reducing these to 27kΩ reduced the hash to invisibility and on test it is now virtually inaudible. Finally while I was at it, I incorporated the relay idea of one of your recent contributors. The switch-on plop, the switch-off chirp and the hiss are now history and I'm back in business. But I still don't really know what blew the op amps! (W.A.J., Nambucca Heads, NSW).

● We doubt whether the tantalum capacitors were to blame for the failure of ICs. After all, you did not find any defective capacitors. Nor will back-to-back capacitors prevent the coupling of large switch-on transients. The more likely reason for the practice of using back-to-back tantalum capacitors is to reduce harmonic distortion at low frequencies where the capacitor's reactance becomes large with respect to the circuit impedance.

The most likely reason for the IC failure was a voltage surge on the mains. This would have been fed to the ICs because the supply rails of the Graphic Equaliser are unregulated. The best way to avoid this problem is to install zener diodes or three-terminal regulators in the power supply. However this will require a complete redesign of the power supply if you still require ±15V rails.

It is true that changing the input and feedback resistors for the input op amp to 27kΩ will improve the signal-to-noise ratio. This will also reduce the input impedance but in most circumstances this will not be important.

Designing loudspeaker crossover coils

CROSSOVER COILS: In several of your speaker systems over the years you have advised constructors that they can wind their own crossover coils by using a certain number of turns of 18 B&S (or 19 SWG) wire on a non-metallic former, 25mm in diameter, 20mm long, with 50mm diameter cheeks at both ends. I would be grateful if you could supply me with some sort of formula that I can use to work out the number of turns needed for such an inductor, given the inductance in millihenries. (D.H., Charnwood, ACT).

● The relevant factor to remember in any calculation of inductance of a coil is that the inductance is directly proportional to the square of the number of turns. This means that, for a given coil former, you can use this direct relationship to come up with an inductor of desired value. Hence, if you have access to one of our previous articles which specified so many turns on a specified former for a given inductance, you are "home and hosed".

We delved into this subject fairly deeply in an article entitled "Hifi Crossover Networks" back in July 1959. This article featured a number of useful charts. On the other hand, you can find a number of general formulas for coils of differing shape factors, by referring to the relevant sections of "Radiotron Designer's Handbook" edited by F. Langford-Smith. This trusty book should be on the shelves of most technical libraries.

For a coil with depth smaller than its diameter, the inductance is calculated by the formula:

$$L = \frac{a^2N^2}{9a+10b+8.4c+3.2cb/a}$$

where as L is in microhenries, a is the average radius of the winding, b is the depth, and c is thickness (difference between the two winding radii). Dimensions are in inches.

RLC BRIDGE: I am seeking your assistance or advice regarding your RLC Bridge in the March 1978 issue of EA. In trying to calibrate the instrument I struck an error of 10 times the correct reading, as under:

1000pF capacitor measures 100pF
.1μF capacitor measures .01μF
.01μF capacitor measures .001μF
10kΩ resistor measures 100kΩ
1kΩ resistor measures 10kΩ
100Ω resistor measures 1kΩ
10Ω resistor measures 100Ω

Your reply in "Information Centre" would be greatly appreciated.
(C.R., McMasters Beach, NSW)

● In a relatively simple instrument such as this, we can think of only two possible causes for the above fault. Either the switch wiring is hopelessly confused, which we tend to discount, or the scale potentiometer is non linear, possibly logarithmic. We specified a wirewound linear pot.

LONG BATTERY LIFE: I have a battery in my car which was installed just over six years ago and still appears to be going strong. Is this unusual and can I expect much more life out of it? Apart from keeping the electrolyte levels above the plates and occasionally checking the voltage regulator, I have done nothing

special to extend the battery life. In fact I must admit to using tap water more often than not, instead of rain water. The battery originally had a two-year warranty, by the way. (D.S., Collaroy, NSW).

● Many buyers of car batteries do not expect to receive much more than the guaranteed life and, of course, since the battery manufacturers have done their sums correctly, that is what most buyers get. However, when battery manufacturers compile their statistics on expected battery life and hence calculate their guarantee periods, the assumption is that they are dealing with an "average" motorist.

Buying a battery with a three-year warranty instead of a two-year warranty does not necessarily mean that you have a better battery. In most cases, you are buying exactly the same battery but paying an "insurance" premium in case the battery expires before the end of the pro-rata guarantee. Manufacturers calculate that premium on the cost of honouring the guarantee.

It also stands to reason that if the majority of batteries last for the guarantee period (otherwise the manufacturer would go broke), then a small minority of batteries must last considerably longer than this period. You have one of those. It also stands to reason, that if battery guarantees are calculated on the care and maintenance given by the average motorist (which is almost nil) then the care given by you is almost fanatical by comparison and you should naturally expect long battery life.

Filling the battery with tap water, incidentally, is far more preferable than not filling with distilled or rain water. Having said all that, you have had a good run.

LCD TACHO/DWELL METER: I recently built the LCD Tacho/Dwell meter as featured in EA May, 1982. Unfortunately it does not work and I am writing to request help!

Instead of installing it in a car, I built it as a portable instrument, which resulted in some changes to the layout. I also added an additional switch to cover 4, 6 and 8-cylinder cars. The changes did not alter the actual circuitry (I hope) and were as follows:

1. The circuit board and DPM200 were not soldered, but joined by wires.

2. The switch used to select 4, 6 and 8 cylinders was a 4-pole 3-position type and broke the connections between one end of the 10kΩ and 100kΩ trimpots and the 220kΩ resistors as well as the connections from the wipers to the dwell/tacho switch. The other ends of the trimpots were joined together and to pins 3, 4, 5 and 12 on DPM200.

The circuit board was made from your pattern by a photographic technique but the trimpots were mounted elsewhere.

The display shows the first "1" only when switched to "Tacho" and the decimal point is also displayed when switched to "Dwell". Adjustment of the trimpots does not alter the display of "1" nor does shorting the points lead to earth. There is no voltage between pin 4 and pin 1 but all other voltages appear correct.

I have replaced the 4001, which was fitted with a socket, and the DPM200, as I have two. Is there any way to check out the DPM200 as a separate item? The circuit appears to be correct (checked 20 times) and components are of correct value.

On the DPM200 there are additional tracks, especially between pins 3 and 4. These would have been soldered if the PCB and the DPM200 had been joined. Is this important?

Can you help? (B.W.T., Frenchs Forest, NSW).

● The fact that there is no voltage between pins 1 and 4 on the DPM-200 module indicates that there is a short circuit somewhere in your layout which is dragging the potential of the common

Problems with the 500MHz DFM

500MHz FREQUENCY COUNTER: It is with regret that I must ask for your assistance with this project. The problem I have is with the display and the ICM7216A chip. The display will not vary with a signal injected although the "0"s in the display light as they should (as mentioned in your construction article), and vary with switching from 4 to 1 (or vice versa) zero digits.

I have conducted all checks that your February 1982 article suggests and "all" seem OK. I confirm all the voltages are (and always have been) correct and that all components are inserted correctly. The crystal is also functioning. The suppliers of the kit can offer me no clues as to the problem, hence my reluctant request to you.

As a footnote I advise that the leads of the two transistors (2N4258) have to be bent specially to suit the PCB. (D.H., Springwood, NSW).

● It appears likely that the problem does not lie with the 7216 chip but with the ECL front-end section involving the MC10116. The fact that you had to bend the leads of the 2N4258 ECL-to-TTL level translator transistors is significant and suggests that the fault may lie in this section.

rail down to earth. Fortunately, this will not damage the module. The display reading shown by the DPM-200 is the overrange display and in these circumstances is indicative of the fault described above. Upon removal of the short circuit, the voltage at pin 4 should rise to aproximately +4.7V.

The thin tracks running between various pins on the DPM-200 (eg between pins 3 and 4) are guard tracks at earth potential. These should not be soldered to the pins, as this will short the pins to earth. From what you have said in your letter, it is likely that you will find that a short circuit betwen pin 4 and an adjacent guard track on the DPM-200 module is your problem.

ION GENERATOR: Is there a simple way of telling if an Ion Generator is working okay? (R.L., Merimbula, NSW).

● Yes. Sniff it. If it smells of ozone then it is probably working. Whether it is working okay is quite another matter. We do not believe that they are effective, although they may precipitate dust particles from the air.

HEADPHONE SENSITIVITY: I have a pair of compact headphones which were given to me as a birthday present. The problem with them is a disappointing inability to deliver any exciting amount of volume. I have enclosed the specifications with my letter. As stated, they are 32Ω. Is the lack of volume due to the mismatch when plugged into my 8Ω stereo socket. Can anything be done about this such as a matching transformer or equivalent circuit? When plugged into an 8Ω source, the volume control on the particular amplifier has to be turned up to twice or three times the setting which I use for the amplifier's speakers, for the same comfortable listening level.

A friend has a similar pair of 'phones, different brand but 20Ω impedance. These produce a much more acceptable listening level. I previously possessed a 15Ω pair of Sony headphones which delivered enormous volume. Can you offer any advice on the subject? (P.S., Chatswood, NSW.)

● First of all, let us talk about the typical 8Ω headphone socket and the likelihood of mismatch. In fact, the typical headphone feed circuit on a stereo amplifier or receiver is simply a resistor of about 330Ω, in series with the output of each channel. So the true output impedance is of the order of half this figure, or around 150Ω. This order of resistance performs a number of functions.

First, it prevents the output of the power amplifiers from being shorted when the headphone jack is being plugged into the socket. Second, it limits the drive voltage to low impedance phones to a safe level, by dint of the voltage divider action. Third, it can effectively improve the signal-to-noise ratio of the amplifier. As far as headphone listening is concerned. if you were to connect a typical pair of phones directly across the loudspeaker outputs of the amplifier, you would become instantly aware of a relatively high level hum and hiss which is not normally audible from your speakers. So as far as a mismatch is concerned there is really no problem since every headphone circuit constitutes a severe mismatch in absolute terms.

Given that the headphone circuit on a stereo amplifier is a current source, ie, resistive feed, you will be better off with a headphone that has a low impedance, for a given headphone efficiency. Now considering the specifications of your particular headphones, it does appear that they are fairly normal. Sensitivity is quoted at 96dB/mW which is a fairly typical figure. Rated power is quoted at 50mW which would give a sound pressure level of 113dB which is pretty loud. And the power handling capacity is quoted at 0.5W which would give a maximum sound pressure level of 123dB which is about the level which most run-of-the-mill phones are capable of. In other words, they should give a very loud sound level.

But your experience suggests that they are well below par in sensitivity. We can only assume that you have been given a pair which just do not meet the spec. We can also say that there is quite a wide disparity in sensitivity between brands and models of these newer supra-aural headphones (which were originally designed to suit the new personal portables). The most sensitive types use the new samarium-cobalt magnets which are very powerful but add only a few dollars more to the headphone price.

In any case, the motto "try before you buy" really does apply when you buy headphones. If you just buy a "bubble pack" from a large retail display you could just be buying a pair of ear muffs.

Electronics Australia Reader Service

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ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Chippendale, 2008.

Notes & Errata

SOUND LEVEL METER (May 1981, File 7/M/59):The errata on page 133 of the August 1982 issue neglected to show the 1kΩ resistor connected from pin 2 of IC5 to the zero volt rail. This is best achieved by soldering the resistor beneath the PCB directly from pin 2 of IC5 to the negative side of the 100μF capacitor which also connects to the common earth point of switch S1.

Wizzard video game . . . ctd from p131

the Commodore VIC-20 or the Tandy Color Computer.

Where it is likely to suffer by comparison with these two machines is in the pressure sensitive keyboard which is not as easy to use as a regular typewriter keyboard. And whether there will be a large range of software to suit the Wizzard Basic remains to be seen.

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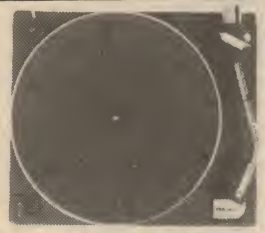

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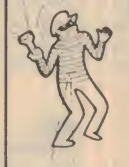

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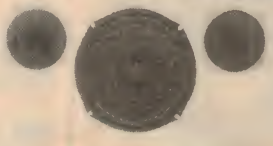

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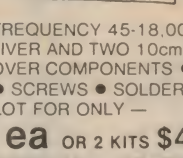

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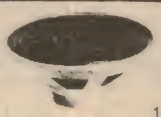

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